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Journal of the Society of Arts.

FRIDAY, MAY 30, 1856.

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ANNUAL CONFERENCE AND DINNER.

The Annual Conference of the Representatives from Institutions in Union with the Society is appointed to be held at the Society's house, on Monday, the 23rd of June.

The Annual Dinner will take place at the Crystal Palace, on Tuesday, the 24th of June. The Right Honourable Lord Ashburton, F.R.S., will preside.

Further particulars will be announced in an early number of the *Journal.*

ASSISTANT SECRETARYSHIP.

In the advertising pages of the Journal of this week will be found a statement of the attainments the Council will expect Candidates for this office to possess. The salary will be £200 a-year, with a prospective increase.

TWENTY-FOURTH ORDINARY MEETING.

Thursday, May 28, 1856.

The Twenty-fourth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 28th inst., Henry Cole, Esq., C.B., Vice-President, in the Chair.

The following Candidates were balloted for, and duly elected Ordinary Members:—

Hunt, James.
Libbis, George.
Mayhew, Charles.
Pinches, Conrad H.
Proctor, Thomas.
Wilson, Edward T.

As a Corresponding Member.
Ward, John.

The paper read was—

THE HISTORY AND PRESENT STATE OF THE MACHINE-WROUGHT LACE TRADE.

By William Felkin, F.L.S.

In fulfilling the duty which I have undertaken, it will be necessary, from the multiplicity of the facts in the series of mechanical inventions and improvements which present themselves in this inquiry, to make a selection of the more important ones. In stating these on my own authority, it is proper to say at the outset, that, in addition to my own personal knowledge, derived from a thirty-six years' close connection with the trade, I have used strict caution in this difficult investigation, so that the truth might be fairly elicited. The facts I shall proceed to state with as much brevity as I can.

Fishing-nets, made by hand, have been used in all ages, and were probably the first articles composed of knotted interstices. Lace has been used for ornament in dress and furniture through all historic time. Netted lace fringes were made by hand amongst the Egyptians, Israelites, Greeks, and Romans. In the middle ages of the Christian era, females in convents, at first, and afterwards domestically, as the favourite employment of ladies of rank and others, used the needle upon plain cloth, to draw aside in various directions the threads of which it was composed. This produced interstices, which were disposed so as to form different patterns. Narrow braidings of suitable textures were also sewn together at different points of their length, so as to form effective designs in lace. Both kinds were often joined together in making up one handkerchief, veil, altar-cloth, or priest's vestment. Almost every variety of interstice or mesh now known was introduced into these lace articles. These kinds of work seem to have prevailed first in Italy, then in Spain, and very soon in Germany, Flanders, France, and England; so that from A.D. 1400 to 1600 they gave profitable employment to the ingenuity and industry of very many females. In 1561, Barbara Uttmann, of St. Annaberg, in Germany, invented the art of making lace, by the twisting, platting, or otherwise weaving threads drawn from spools or bobbins, and passing them round pins. This was done, so as, in the first instance, probably, to produce a series of regular meshes in plain net. But, in due time, cloth-work, open work, and all other requisites of lace—at last including thick threads, or gimping, to give finish and effect to the pattern—were introduced, in the manner now universally employed in making pillow goods. When made plain net, embroidery was put in with a needle, or flowers were attached upon its surface. This new method of making lace, by working on the pillow, quickly superseded the old needle-wrought lace. Becoming known throughout the north of Europe, it speedily made its way from Flanders into England. In both countries, as also in France, schools were established to teach the art. Such a school was set up, in 1626, at Great Marlow; and by 1640 the pillow lace manufacture was greatly extended and well settled in Buckinghamshire. A rivalry was long shown between this country and France in the manufacture of bone or pillow lace; "English point" was equally esteemed with "French point," "d'Alençon," "Valenciennes," "Brussel's point," "Mechlin," wire ground, platted, twisted, or any other. In the early part of the present century, there were one hundred and thirty thousand persons employed in the making of pillow lace in various English counties. At Honiton had been established the production of flowers and sprigs, in imitation of the bouquets and floral ornamentation common in real Brussel's lace, and which were usually sewn upon a plain net three-twist pillow ground. These sprigs, &c., whether Brussels or Honiton, are now ordinarily applied to *machine-wrought* three-twist net.

We have to trace the course whereby the productions of this intricate manual art have been successfully imitated. A series of the different meshes or grounds produced by machinery were placed in the Exhibition of 1851 by one of my sons. These specimens are enlarged to about the size of an inch each mesh, and show, by different coloured threads, the diverse course of each, necessary to the attainment of the required results. Nearly every known mesh—certainly every useful one—has been mechanically produced; and into most of them good, in many, elaborate and tasteful, designs have been introduced. This has been effected by controlling, in the arrangements of the machine, either sets of threads, or, as in the pillow, every individual thread employed in the operation.

The invention of the stocking loom by Lee was one of the most astonishing instances of genius, perseverance, and success, the world ever saw. It was a great stride to take in advance, and that by a clergyman, from three knitting skewers in the fingers of a woman, to a machine so simple in principle, and yet requiring such complicated movements, so multiplied in its parts, and in that age so delicate and difficult of handicraft construction. Yet his ingenuity, and its practical results, as useful as they have become universal, unimpaired in their remote influences by the tale of the neglect he experienced at home, and misfortune which closed his unhappy career abroad, have so filled the thoughts and fired the imaginations of the successors of this great man, who, in the town of Nottingham, have ever since been employed in improving his handiwork, as to sharpen their wits and make cunning their fingers. The skill of the working smiths of that place has been for two centuries a proverb, and has become celebrated far and wide. It is not too much to say, and not unimportant to remark, that the example of Lee's thoughtful, indomitable perseverance, has been followed, even up to the present day, by more surprising results than can fairly be attributed to the influence of almost any other mechanical inventor. This will be seen in the history we hasten to trace out, and in the extent and importance of the manufactures directly or indirectly emanating from the stocking frame, by the inventions of those who were educated in its construction and use. This machinery is now made of so ponderous a kind as to require steam for its moving power, of greatest efficiency; it is composed of many thousand parts; and these of so delicate and nice an adjustment, as that they must be made mathematically true, and turned out of hand with absolute certainty of harmonious working, or they would be useless, if not self-destructive. Whatever, therefore, file and forge, hammer and plane, can effect, is seen in the lace and stocking machinery of the present day. Such has been the reflex influence of adaptations in each trade upon the other, that it can no longer be said with truth, as formerly, that the stocking frame remains unimproved. By late alterations in the latter, they have become fit companions in mechanical excellence.

By Strutt's patent, 1758, for "Derby rib" hosiery, a variation of the uniform or plain looped work of the stocking frame had been shown to be practicable, and might be made extensively applicable. It was effected by shifting one or more loops to the hooks or "needles" beside them, and the result is to make an interstice. The operation was first done by hand, then by an added piece of machinery, and eventually so as to produce a pattern. The lace open work on ladies' ancles and insteps is an example of fancy stockings thus produced. To place a whole row of points in number and situation equal to the number of hooks or needles intended to be operated upon in the stocking frame, and thus by applying them mechanically to these hooks, and removing the loops from them, was the object of Morris's "œillet" or eyelet-hole patent of 1763, perfected in 1781. This invention was at first employed in the fabrication of open work mitts and gloves, and was a great step towards using many of the component parts of the stocking frame in the manufacture of lace. It was pirated, by applying the principle in almost every possible form; but the patent right was sustained. Morris derived a good profit, and the Nottingham lace trade commenced its first epoch of development.

In 1768, Crane, of Edmonton, by applying a kind of warp frame to the stocking loom, made a "vandyke" looped stocking web. The application of "tickler" apparatus to shift loops on this frame, had issued in producing various open works and lace articles; such as so called "Valenciennes," "flowered," and "spider" nets. To this machine may be traced the origin of the present "warp" frame. In the same year, Hammond made some kind of lace upon the stocking frame which he considered bore resemblance to that worn by his wife upon her cap. Dissipated habits seem to have prevented his attaining any practically useful results.

Taking up Morris's patented principle soon afterwards, Arthur Else made such adaptations of machinery in and to the stocking frame, as laid the foundation for the future construction of the "knotted," "twilled," "stump wire," and "mesh" machines. In 1770, or thereabouts, Else and Harvey took from London to Nottingham what was called the "pin" machine. It was extensively used for making lace there; but, from some now unknown cause, it ceased to be employed. Its construction, mode of operation, and first products, are, and have long been, forgotten there. But this machine was soon introduced into France, where, through modifications, it soon became the prolific source of employment and wealth, in the immense production of single and double silk net, at Lyons; and, still later, being obtained by Austria, has issued in their important manufacture of "Vienna" silk net. The "*tulle simple et double de Lyon et de Vienne*" is known and used wherever lace is consumed. Had there been a museum for machinery and its products in London, Nottingham, and other seats of our industry, specimens of this and other now unused and forgotten ingenious combinations would be forthcoming. This has long been a cherished desire on my part and many others, who do not despair of its being realised before long. On several visits to Lyons, thirty years ago, I endeavoured to obtain a sight of this modified machine, as well as the way in which the silk net was dressed; but, contrary to my experience there in the silk manufacture, was always refused. Before 1780, Robert Frost adapted the "tickler" stocking frame, so as to make a "fining," round which thick threads could be worked by the needle, and so produce a pattern. He also made a "square" net from the stocking loom, and, in conjunction with his brother Thomas Frost, took out patents for several of these adaptations. In some of these, an instrument like the barrel of an organ was used for operating upon particular needles or points.

In 1777, either Robert Frost or Holmes—the latter, a workman, who lived and died poor, at Nottingham—discovered the mode of making that lace from the stocking frame, which was afterwards so well known and extensively consumed under the denomination of "point" net. To which the plan belongs is not known; both claimed it—probably each helped the other in bringing it into operation. This "two-course point" net was produced by a single thread passing across the whole course of needles of a very fine guaged stocking frame; the loops thus formed being removed sideways by points operating upon the whole series, and dealt with in a manner too intricate to be easily described, or, without drawings or models, understood. A perfect web of lace was formed, of six-sided looped meshes, highly elastic, and, of course, all weft, like the web from the original stocking frame. By the consentaneous opinions of all who could speak with authority upon such a subject, the mechanism of this frame was the most delicate of any ever employed in this or any other trade.

The next year—1778—by the efforts of John Lindley, Hiram Flint, assisted, it is said, by Morris, the point net frame was so improved as to produce a better article, that first made having been of a loose and inferior texture. In 1786, it was made a firm and durable article by Rogers, of Mansfield, or Hayne and Bagally, of Nottingham, each claiming the improvement. During several previous and subsequent years, Messrs. T. and R. Frost had succeeded in ornamenting point net upon the machine. From 20 machines at work in 1780, there were, in 1810, 1,500 point net frames, worked by men, making almost entirely silk net. 15,000 people were engaged in preparing and embroidering these goods for the market. A long war, decreased demand, and great competition, superinduced slight material and inferior workmanship. The decay of the trade by 1815 was complete. The last twenty-seven frames were sold from 1825 to 1828, and neither frame nor hand is, I believe, now to be found, of all those who, forty years ago, were so busily engaged in laying this the basis of the lace trade of Nottingham.

It may be mentioned here that, notwithstanding the extraordinary elasticity of cotton, and still more of plain silk net, the mode of payment to the workman was, for a long time, by the yard in length. This mode of measurement was so uncertain and capricious, not to say manifestly unjust, that much discontent was the result. At length, a method of self-registration, dependent upon every advancing movement of the machine, was found out, and being first applied to the "point" net frame, has proved the safe and unquestionable index of the workman's labour, and is now used in every mechanical department of the trade. Lace goods are now universally sold in the rough or unprepared state by this "rack" of 240 meshes in length, in the finished state by the yard, or dozen yards, or article, as the case may be.

In 1791, William Dawson, a stocking-needle maker in Nottingham, took out a patent for the manufacture, by machinery, of net, or lace sashes, purses, and braces. He was an ingenious mechanic. Dawson devised wheels, with uneven surfaces, which should, by their inequalities, raise or lower parts of the machinery, and which are now in constant use. He had Crane's machinery before him, in which the stocking loop was produced, not upon a continuous thread thrown horizontally across the machine, as in Lee's frame, but upon a series of threads placed longitudinally, as on the ancient weaver's beam, each of these threads answering to its respective "needle," or hook, and these threads looping, as the guides were passed under the long beard or hook of the needle, to which it belonged, were conducted sideways to the next needle, and then back again. Thus a solid fabric might be produced. If the meshes were removed by the application of the points in front of the needles, then an open-work mesh would be the result, which, by return of the loops and repetition of the process, would produce plain lace net work. This is the origin and operation of the present warp machine. At first, hosiery goods, such as cloth for trowsers, sailor's jackets, cut up hose, and gloves, were made from these frames, and some of these articles continue to be produced from them in large quantities up to the present time. A small quantity only of warp lace goods were made for several years, partly owing to the successful employment of the point net frame in making silk net, and the use of which for embroidery in imitation of French net was then very general, and perhaps, in some measure, to the want of two-thread cotton yarn of sufficiently fine numbers and good quality for the use of lace machinery. This desideratum was supplied, about 1805, both to the Nottingham and Buckinghamshire trades, by Mr. Samuel Cartledge, of the former place. Having succeeded in doubling it of the required quality, he introduced it into both businesses, and received, from the gentlemen engaged in cushion lace making, their thanks, at a meeting held especially for that purpose, at Newport Pagnell, in 1815. Meantime, the beginning of the present century saw a revival in the use of warp machinery for making lace. By 1810 it was competing successfully with the productions of the point net frame. For variety of productions and relative speed, the warp frame is undoubtedly the most universally applicable of any machine whatever. Every class of thread may be used—silk, cotton, animal wool. The stoutest fabric for warmth, and the lightest gossamer silk lace, are manufactured upon it with equal ease, and the necessary change of arrangements effected in an hour.

The manufacture of warp lace proceeded satisfactorily, subject to the fluctuations incidental to trade generally; but to which it may well be supposed an article of mere luxury must in every branch, be more especially liable. The variety of lace articles since obtained from the warp loom, has been almost incredible. Silk blonds and edgings, silk nets and laces, cotton tattings, pearls, edgings and laces—Doyley's, ante-macassars, of patterns effective from design, and thick threaded, pearled, and finished in the loom—are amongst the objects of the largest consumption. They are not only used at home, but enter into our export trade to a very large amount. The low prices at which they can be sold, combined with the durability of the heavier classes of cotton warp articles, make them the sure pioneers of our trade in more expensive goods, where, without them, but little lace would go. Orgill, Whiteley, Herbert, Gantley, and Dexter, have promoted the development of the capacities of the machine; Boot, Roberts, and Copestake, early pushed onward the warp fancy trade; and T. Herbert's fast pearled cotton tattings—Wild and Bradbury's laces and shawls—and Ball's velvet laces are instances of excellent efforts for the production of useful, elegant, and in the last named, almost regal novelties. There are in 1856, only about 550 machines—expensive wide having replaced less effective narrow ones. The number of warp machines making lace in 1843, was about 800. Of these 300 were employed upon silk, and 500 upon cotton goods. The machinery, buildings, &c., required a capital of about £350,000; employed about 5,000 hands; used up in raw materials £35,000 worth of raw silk of the value of £45,000 when prepared—and £25,000 worth of cotton wool of the value of £60,000—together £60,000, the cost of raw materials wrought up into £150,000 worth of silk, and £200,000 worth of cotton goods, making a total return of £350,000 for that year; of which £290,000 remained in the shape of wages, interest of capital, and profits. This business was, and is still transacted, by about fifteen houses in Nottingham and its neighbourhood.

All the machinery in the lace trade, if in factories, is worked about twenty hours a day, by two full sets of hands in shifts, each taking the night work in rotation. This is, therefore, the case with a large part of the warp machinery, of which the greater portion has been rotary for some years; and for the most part, these rotaries are worked by steam power. Wages are very similar in amount to those earned in the bobbin net trade. As there are no surplus labourers in the district, warp hands partake of the general prosperity of the class to which they belong. They are marked also by similar characterestics.

I have thought it most convenient to give the foregoing statement as to the warp trade without further interruption, in order to give a more perfect idea of its origin and progress. The above, which is about its present amount, I shall add to the statistics with which the paper will conclude.

Before proceeding to notice the more important branch of the machine wrought lace trade, that of "Bobbin net," the machine for making which is in different hands generally, the produce of both, however, going into the common mass of the Nottingham lace trade, I would remark as an important fact having a bearing upon the course and condition of each trade, that the warp and bobbin net manufactures, in regard to kinds of goods, style, patterns, and prices, act and re-act upon each other in a rapid manner. The machines in each branch, if of similar widths, are almost equally costly, (the bobbin net frames are the most so) both require great skill and nicety of construction, and each must be worked by hands of a superior class. These are circumstances which serve to keep up the general supply of mechanical talent and skilled labour. In times of difficulty, however, the quantity made has always been such as to issue in over production in those classes of articles which are common to both machines, and prices have suffered accordingly.

Reference to the two fishing net patent machines has been left until now, for reasons which will appear when we come to Heathcoat's patent of 1809 for making bobbin net.

In the Society of Arts Transactions, 1796, vol. 14, p. 273, is a drawing and minute description of Boswell's fishing net machine, for which he received the Society's award of fifty guineas. Boswell knew the stocking frame, and March's attempts to improve it. He uses roller beam, comb, sleigh, jacks, and hooks, and produced by using a single thread placed on a netting needle, and passed from side to side of the machine, a web of 68 meshes in width, and 8 feet wide when stretched out. The piece presented to the Society was 30 yards long. The corners of each mesh consisted of the true fisherman's knot, and of course were quite fast. The selvages were also perfect. It is an ingeniously contrived, though complicated frame; but has never been brought into general practical use. Boswell's letter to the Society speaks of "making exceedingly fine net from such a machine very shortly, as he hopes." I knew him well, and travelled abroad with him in 1824. He had not then realised such expectation, I am sure, or I must have known it.

Robert Brown, of Nottingham, patented in 1802 a machine for making fishing nets. G. Whitemore is mentioned as being concerned in the invention. Unlike Boswell, who used only one thread, and passed it horizontally across his frame, R. Brown used as many threads as he had looping hooks, and drew them off longitudinally. They were divided into two equal parts; one set put into metal bobbins, of which the sides were so far compressed together, as only to receive twine used in the making of the net. Each of these bobbins was inserted into a slot of iron; a groove in which received it, and allowed it to turn round, and give off the yarn; one of these bobbins and slot is on the table before us. This set of threads, Brown called "sinker threads." The other set were drawn off bobbins of the ordinary shape and width between the sides, which were fixed upon pins standing on a bobbin board, and this set he called "needle" threads. He provides for making loops, by using a set of hooks. Each hook makes its loop, draws it aside, and this loop being put into a triangular shape, large enough to allow the instrument carrying a bobbin to go through it, the thread is passed round and over the "sinker," which having passed, there is a knot formed. The threads which are thus passed round being then drawn tight, are thus firmly connected with the next ones, and the row of meshes across is finished. This effort at description has been thus particular, because the bobbin and instrument by which it was conveyed through the loops has assumed special importance; for this machine of Robert Brown's has been described as "possessing all the essential principles and properties of Heathcoat's second bobbin net machine," (patented seven years after this machine) "and to be to all intents and purposes a bobbin net machine. That to it must be traced the invention of bobbin and carriage; the method of using two divisions of threads, the warp and the bobbin; and to it alone belongs the beautiful idea of twisting two divisions of threads round each other." After more than one examination of the specification, and on each occasion assisted by talented mechaniciens, whose conclusions seem borne out by the document and drawings, I think it must be said, with every desire to do R. Brown's machine justice, that "in this specification there is no proposal for twisting threads round each other, nor does it seem possible to effect this process by this machine. The division of threads by Brown does not justify the use of the terms *warp* and bobbin. The bobbins and carriages are plainly adapted to pass through the loops of a fishing net maker, like his hand needle. Neither their design nor construction would necessarily suggest the bobbin and carriage of Heathcoat's machine. With the exception of the last named instruments, R. Brown's machine does not possess any of the essential principles or arrangements of Heathcoat's machine." R. Brown's fishing net machine never seems to have come into general use for making fishing nets. The specification says, "fine nets or lace might be made from it." I cannot find that he ever made any. His son observed to me lately, "that without the bobbin and carriage, twist net cannot be made—my father made the first bobbin and carriage, and patented it in the fishing net frame—fell into poverty—became insane. The trade gave him 12s. a week, and in a few years he died." It seems right to give his views, although I differ from the conclusion that the merit of the bobbin net machine belongs to his father. Robert Brown's ingenuity was unquestionably great; and under more favourable circumstances, there is no doubt he might have achieved success and fortune. He patented in 1804 an improved "Warp lace frame, to make Brussels, Valenciennes, tic-tac, and other lace." This never seems to have come into practical operation.

In passing, I must state that this son of R. Brown has arranged a bobbin net machine so as to produce some of the most intricate combinations of threads and meshes hitherto made. His want of means prevents his bringing it into use. I have the meshes, but have not seen the model, or a description of the principle on which it is constructed.

We now come to the circumstances attending the invention of the bobbin or twist machine. Many persons in Nottingham and some elsewhere, had been endeavouring since Morris's time, to produce by machinery an exact imitation of cushion lace. The difficulty lay in providing by mechanical movements, for the threads twisting round each other, and then travelling in three separate sets and directions, after thus twisting, *i.e.*, part longitudinally, and part to the right hand diagonally, the other part to the left hand diagonally. The names of most of these persons are forgotten. Some became lunatics, some committed suicide, others died from chagrin and want. Amongst those remembered still, and whose efforts were most noticable, are the following; John Lindley, jun., spent much time in endeavours to produce twist and traversed net, after his assisting to improve the "point" net. A claim for the invention of the bobbin and carriage has been put in for him, under the excitement attending the contested patent rights in 1813. Some said, he had made a close approach to a single tier twist frame. Beyond the assertion, I find no trace of this at all.

It is probable that the efforts of Edward Whittaker were mixed up with those of Lindley, towards the time when the attempts of each were thrown aside. Whittaker made a machine, in which were eight or ten threads to an inch, producing an article (according to his statement) showing wavy lines, like blond net. He used a comb-bar like the jack-bar of a stocking frame. His threads were placed entirely upon bobbins, and each bobbin was fixed in a nick cut in a sort of carriage. Every other bobbin had to be lifted over the next one, and let down into the vacant space. The first ends of the threads were fastened to the further end of the horizontal machine; and the twist obtained was pushed up by the hand. Whittaker showed a bit of traversed lace, which he said had been made upon his apparatus. It would seem, relying upon all other and far more credible testimony, to have been hand made, and that lace never was made mechanically by him. This attempt to mechanise the art of lace making, presents the use of a modified shuttle and pirn—a not very manageable bobbin and carriage, not reduced into the size necessary to pass through the space occupied by an interstice of lace. His other mechanical arrangements were not calculated to forward, much less to attain, the end proposed.

Then Charles Hood, knowing him, through being connected with Taylor and Hood, who furnished Whittaker with the money expended in his attempts, and seeing (as he C. Hood asserted) that lace could not be made from the apparatus, as it was put together by Whittaker, took the project out of his hands, and modified the machinery. According to one, C. Hood dismissed the bobbins and carriages; another avers he continued their use. His machine was horizontal; the bobbins were lifted by alternate shifts each way, one half over the other, and thus a twisting process was carried on. He carried up the twist for perhaps two yards or more, by means of a row of at first wooden, and afterwards iron pins or points. The crossing was forced up in like manner. Thus he made upon two such sets of instruments, about twenty yards in length of a net about nine inches in width. This lace did not traverse, but was a straight down net. Thus, C. Hood stands in the position of having far more nearly approached the solution of the difficult problem in hand.—There seems to have been on the part of John Moore also, as near an approach, or even nearer, to making a twisted net. But he failed in obtaining a traverse. His further efforts were rendered useless by Heathcoat's success. He appears to have been a clear-headed mechanic.

Amongst all these parties there seems to have been but little distinct idea of what was really necessary to be done. Parts of machines there were, lying on all sides of them, which, perhaps, might be made mechanically available. Many things, as in the common weaving loom, its warp beam and division of warp threads in the reed. In the stocking frame, its "slea" and "comb," and "guides," the "points" of the point net machine, and many other instruments might be adopted or adapted. But the grasp of mind necessary to choose, or invent, or adapt what was needful in the accomplishment of this mechanical feat, was not an every-day manifestation of genius.

It was during the time that the persons we have named were labouring and planning ineffectually, that John Heathcoat entered upon and accomplished it, after several years of great mental labour, and occasionally some serious physical privations. He was a native of Long Whatton, in Leicestershire, and between his twentieth and twenty-fifth years, was employed as a smith and setter up of warp frames in Nottingham. During this time he turned his attention to the question of constructing a twist traverse net machine. More than one circumstance had fixed his mind from boyhood on this problem, and he determined, if practicable, to solve it. He first got a sight of pillow lace, in process of making; then carefully dissected the product. Tracing the threads, he soon found they might practically be separated into three classes—longitudinal, right, and left diagonal. After much reflection he was led to the conviction that the longitudinal might be put on a beam, and so constitute a warp. This discovery simplified the subsequent processes, in attempting to mechanise the operations of the pillow. Having thus constituted the warp of half the threads necessary to make the lace, Mr. Heathcoat proceeded to put threads on an equal number of bobbins or spools, analagous in shape to those used by the cushion lace makers. These were arranged on pinions, and radiating, they were made to twist round the warp threads. A row of pins forced up the twist and crossing, to close up the mesh of right size and shape. These pins were placed on a bar, but they spread out on receding from the work, and contracted when brought into contact with it. At first the bobbins had been placed in a straight line, but thus arranged the side ones gave off too much yarn; therefore, they were placed in a segment of a circle, all working at equal distances from the net when formed, in whatever position they might happen to be. The bobbin threads were made to traverse, the one half to the right, the other half to the left, each one, as it arrived at the side, being caused to return until it reached the other side, and so on. From the space occupied by the bobbins, only very narrow strips of net could be produced upon this machine. Nevertheless, it might justly be described as a real mechanical pillow for lace making. In the opinion of many men of high mechanical talent, and adopted and expressed by Serjeant Copley in 1815, it was an extraordinary instance of mechanical genius. This frame was patented in 1808. About five meshes of plain net can be made per minute upon the pillow. By this frame, as the twistings and subsequent crossings took place across, all by one movement for each operation, as many *rows* of meshes could be produced per minute.

Upon shewing the net of an inch or so in width produced in this manner to Mr Chas. Lacey and Mr. Thos. Fisher, the patentee found that the usefulness and value of lace is much enhanced by its greater width. He, therefore, decided to attempt making it a yard wide. The warp fixed upon a beam secured all that could be necessary in regard to one-half the threads, of whatever width the machine might be. The bobbins must, however, be got to pass and re-pass in the same space. The large bobbin was discarded, and a flat thin bobbin put into a carriage just thick enough to hold and convey it was contrived, and, after many difficulties, made thin enough to do the work. It had been intended to pass and re-pass all the carriages in one set. This plan was afterwards adopted by J. Levers, in the machine now extensively used, bearing his name; but to get, at that time, the bobbins and carriages made thin enough presented such a difficulty that Mr. Heathcoat hit upon the plan of dividing these into two systems, and thus was enabled to use them of double the thickness. The carriages had a long steeple top to carry up the threads nearer the work.

Thus this second machine, known as the "Old Loughborough," from the place to which the inventor had removed, was patented by Heathcoat and Lacey in 1809, and was capable of producing any width of net required, though they were at first constructed only half a yard or a yard wide. The threads were twisted and traversed; bobbins and carriages worked double tier; had a warp beam, a work beam; bobbin threads carrying each way diagonal weft; travelling in carriages, taking the thread from before the warp threads between and behind the warp threads, and *vice versa*. There were movements for shifting the whole sets of threads in warp and bobbin series laterally, by which the sets of threads changed their situation respectively, and twisted the bobbin threads round the warp threads. Also, for passing the bobbins and carriages, half one way and half the other way, sideways, exactly the space between two neighbouring threads of warp, so as to cause a crossing of these bobbin threads to form the top and bottom of each mesh. There were rows of points answering to all the pairs of twisted threads and crossings to force them up to the work beam, and to hold up the work when brought there. The warp threads were passed through guides. Four combs (since reduced to two) were placed at suitable intervals, through the circular segmented grooves of which the carriages safely travelled; and a very ingenious plan was devised of causing the last carriage on each selvage to be left behind one move, and then to enter upon the return course to the other selvage.

The increased width of the article produced by this second machine caused the first patented one to be permanently thrown aside. The introduction of the article into the market formed a new epoch in the lace trade of Nottingham. The second patented machine was a complicated one; it required sixty motions to the formation of a mesh. A workman in one of these machines, 36 inches in width, could produce 1,000 meshes a minute. The motions have gradually been reduced to six, and a machine five yards wide will turn off 40,000 meshes per minute with ease. The first finished pieces were sold at 100s. the square yard; in 1813, 40s.; 1815, 30s.; 1818, 20s.; 1821, 12s.; 1824, 8s.; 1827, 4s.; 1830, 2s.; 1833, 1s. 4d.; 1836, 10d.; 1842, 6d.; 1850, 4d.; 1856, 6d. The last is about a natural average price.

The title to the invention of a machine whose incipient capacity was so greatly in advance of previously known means of production, and which was soon found capable of improved action, and vastly extended powers and results, was not likely to pass unquestioned. Accordingly, a number of claimants for the honour, if not the profit, of the invention, arose on the one side, and infringers quietly set to work on the other. Much was said and written during the patent to lessen and impugn the claim of Mr. Heathcoat. I have diligently consulted a surprisingly voluminous mass of papers, briefs, and evidence on all sides, and, as far as possible, on all points of the controversy. It has been my desire to use impartially these materials, and to give Lindley and Whittaker their due for their bobbin; to R. Brown, for his bobbin and carriage; and to Charles Hood, for using these instruments, so far as he did employ them, in approaching more nearly to success than any of his predecessors. Also, it may be presumed that Mr. Heathcoat might, and almost of necessity must, have had his mind directed in some degree to the attempts of others. Before completing his own machine, he had, however, seen none of either Brown, Whittaker, and Hood's machinery. To him, I have no doubt, belongs the singular merit of inventing the twist traverse or bobbin net machine. Most of the instruments he used were known before, but used for other purposes, or in other combinations. Some had been employed in unsuccessful efforts to do that in which he succeeded. In the hands of his competitors, these instruments had been practically useless as to the solution of the intricate problem. Whatever these might be, Mr. Heathcoat relegated the necessary parts into their appropriate position, giving them form and movement by his mechanical skill, suitable to the attainment of the end he had in view; and thus, as it seems to me, not only was the first to construct (which now no one doubts), but *invented the machine.* You know the lacemaker's cushion; you have the machine before you, and will form your own estimate of the patience and skill displayed in its construction. With Lee's exception, they appear to me to be unique. The opinion of Sir I. Brunel, and adopted by Sir V. Gibbs, on the trial of "Boville *v.* Moore," 1816, seems the right one, and will in time be generally acquiesced in, "that when Mr. Heathcoat had separated one half of the threads, and placed them on a beam as warp threads, and made the bobbins which carried the other threads act between and around these warp threads, so as to produce Buckinghamshire or pillow lace, the lace machine was invented."

The occasion of this trial was important. *John* Brown (not Robert), the real plaintiff, had patented, in 1811, a bobbin net machine, in which, using every one of Heathcoat's essential parts of the machine of 1809, he caused the *warp* threads to traverse, instead of the *bobbin* threads. Finding Moore working a similarly constructed "traverse warp" machine, he brought an action for an infringement. A verdict was given for Moore, the defendant, on the ground "that both machines were infringements upon Heathcoat." Serjeant Copley defended Moore, receiving 100 guineas fees. The defence cost £4,200. The future Lord Lyndhurst was determined to understand the machinery practically, and worked the model on the table with such ease and skill, as to astonish alike judge, jury, counsel, and spectators. An omission by a copyist of one line in the patent induced Heathcoat not to stop infringers until after this trial had indirectly established its validity. Before this patent, only about fifteen lace patents had been granted during a hundred years. Since, there have been upwards of one hundred and twenty, chiefly for modifications of the bobbin net machine; some of them, however, of great ingenuity and importance, also of most expensive character; all, as in the "old Loughborough," divide into the essential systems of the warp and bobbin threads—twisting and crossing. In dealing with these operations, and governing their results, admirable skill has been displayed, which we shall proceed to notice in the improvements as they occurred.

The "traverse warp" just spoken of was specially adapted, and has ever since been used, for the production of narrow breadths, spotted laces, blonde edgings, and imitations of real cushion laces. The singularly clever way in which Heathcoat's machine was travestied, was noticed by Mr. Babbage, twenty years ago, when inspecting the traverse warp with me, at Moore's factory, and he described it as showing "great genius and little science."

In 1816, there were found to be one hundred and fifty-six infringers, of whom were two clockmakers, two blacksmiths, one victualler, two butchers, one coal-dealer, one joiner, thirty-one framesmiths, and one hundred and sixteen manufacturers of lace and hosiery. This state of things led to a levy of tribute or license money. In 1819, about £10,000 was paid to the patentees for the year's tribute upon about 600 machines. Heathcoat had then 147, and Lacey 127 machines, of course additional to the others. Notwithstanding this charge, levied weekly, and the outlay upon the construction of each machine of several hundred pounds, the profits gained were so large as to attract into the fabrication nearly all the mechanical skill and spare capital of the district.

Amongst the plans brought out to adapt this machine for the production of special classes of goods, in 1812, the "pusher" (so called from one of its operations) was constructed by Samuel Clark and James Mart, of Nottingham. This frame, with the Jacquard principle applied, is now employed to a limited extent. Cotton net and silk net are made upon it, with excellent "fining cloth work" of suitable patterns, to be finished by the needle-embroiderer passing thick threads around and through them. Cushion goods, in such articles as shawls, berthas, veils, &c., are closely imitated by this process. Mr. Vickers and Mr. Reckless have long been eminent in this department for the superiority of their designs and work. Specimens of Mr. Vickers' taste are before you. The "mantelet" required 4,250 cards.

An ingenious machine was constructed about 1816, by John Hill, to produce a plain ground, each mesh having two platted and four twisted sides, in exact resemblance of real plat work. The mechanism worked horizontally, required great space, was very slow, and its product was too expensive to answer. Several of these machines were, however, worked under the care of a Miss Woodward, of Basford, for two or three years.

To Mr. William Morley, a mechanic of Nottingham, the trade has been indebted for several important practical improvements. He arranged his "straight bolt" in 1811, but though there were improvements in the spur selvage wheels, and for the change of the bobbin and carriage in reaching the selvage, which have ever since been retained, the peculiar action of the "straight bolt" in the machine drew thread irregularly, and resulted in uneven courses of meshes. He saw the defect could be remedied only by returning to the circular combs; he therefore reduced them from four shorter combs, as in Heathcoat's frame, to two longer segments of circles, as at present in use, and otherwise simplified the movements of the machine. This gentleman possessed much mechanical knowledge in connection with this business, and by his skill and industry accumulated great wealth. He died a few months ago.

Mr. Heathcoat took out another patent for improvements in 1813.

Mr. John Levers, senr., of New Radford, Nottingham, assisted by one Turton, arranged a machine (called by his name) upon the single tier plan. By this time the very thin bobbin and carriage required, and which had induced Heathcoat to lay aside this system, could be made with much less difficulty. To avoid the patent right, he made his machine at first horizontal; it would not work properly, so he soon restored it to the perpendicular position. This machine is far the most delicate, and, therefore, the most expensive of those principally used. It, however, admits of such alterations of meshes, fine work, thick threading, and all kinds of breadth patterns, especially narrow ones, all being of late years regulated and governed by Jacquard apparatus, that this system of machine cannot be too highly appreciated as to its usefulness. Mr. Birkin, who has, with singular talent, comprehended the power of this machine, and by seizing the most important classes of real and other laces, particularly plat cotton laces, and black and white French silk, blond, and other edgings, and bringing them perfect off the "levers," exhibited a good specimen of his "levers" machinery. It will be recollected in the year 1851, in Hyde-park; since then the product from this class of best silk laces has been unparalleled. Mr. Birkin's productions from the Levers' are on the table.

About 1815, Mr. J. Lindley, of Loughborough, in connection with Mr. Lacey, (the partner in the patent with Mr. Heathcoat) brought out a plan, in which was an endeavour to combine the peculiar systems of the "levers" and traverse warp, and to be worked by a rotary hand movement. Unhappily for the originators of the scheme it proved unsuccessful and ruinous to them, in the business they carried on at Tottenham, Middlesex. If for nothing else than containing a proposal for a rotary action, it was an important effort.

The practice of frame breaking, beginning in the three hosiery Midland Counties in 1811, was revived at Loughborough in 1816. Heathcoat and Boden's factory there was entered, and the principal part of thirty-seven lace machines was destroyed, depriving them of seven or eight thousand pounds worth of property. Ten men were tried and convicted, and eight of them executed for this offence.

The owners forthwith removed their business to Tiverton, Devonshire. Mr. Heathcoat has now in his possession upwards of three hundred machines. They have all been constructed on the circular principle, and have had rotary motion given, chiefly by means of water power, which is supplemented by steam. The larger part of this machinery has been employed for the last thirty years in making silk net. "To his zeal and perseverance the trade is indebted for the discovery and application of the dress and finish of silk net as practised by the French, and which is giving by the demand it has created, employment to a large capital, and thousands of work people in the bobbin net trade." From Tiverton, off shoots took root at Barnstaple and Chard, in which places together about 400 machines are at work. The produce of Tiverton is sold in London; so is that of Mr. W. H. Nunn's traverse warp factory; also usually making silk goods, which is located in the Isle of Wight. With these exceptions, the produce of the whole English machine-wrought trade is sold in Nottingham, through the medium of about one hundred and fifteen wholesale houses.

The great increase of machinery in this trade had drawn attention in 1816 to the necessity for improved qualities in Manchester fine yarns. From that period, numbers from No. 80 to No. 280 in Nottingham trade, have found an increasing consumption, and as lace machinery soon spoils if not constantly worked, a more regular demand exists there than in any other branch of the cotton trade. Several large doubling establishments have been long at work in the town and neighbourhood; others, still larger, for throwing silk, are in active operation there. Three years ago Mr. John Morley, the public-spirited son of a worthy father, Mr. W. Morley mentioned above, commenced successfully to *spin* fine numbers of cops, as well as to double them into yarn in Nottingham. In 1810, No. 220 doubled yarn was 100s. per lb.; in 1856, 10s.; 240 was 140s., and is 13s. per lb.

It had been observed by Mr. Samuel Hall, of Basford, Notts., to whom not only this but other trades are deeply indebted for his scientific improvements, that both cotton yarns and fabrics, especially lace net, were fibrous, and the interstices not clear. He patented inventions for passing both thread and nets, or other substances, through gas or other flame, and thus singeing off fibre without injury to the articles, thereby effecting a great improvement in them. Mr. Hall's improved starch is well known. He was the first, so far as I know, who availed himself of extended advertising to get an invention or article into demand. His specimens of gassed thread and lace fairly placed beside ungassed ones, will be remembered as being found in every number of several periodicals for years together. He effectually made Urlings (*i.e.* bobbin) net known far and wide.

Great profits increased lace machinery and stimulated production so much, that the patentees and licensees agreed, in 1819, to send their goods to be sold at a "mart," constituted by deed, with a proprietary committee and common fund for its management and support. To this appear the signatures of patentees, 82 manufacturers, and 82 other owners of frames. The widths of frames of patentees had grown to be 5 qr. to 8 qr., of tributaries 3 qr. to 6 qr. wide at that time. This scheme kept up prices, and, of course, increased the machinery and infringers at a great rate. Notwithstanding high professional opinion in favour of its legality, general opinion protested loudly against it, as an infringement of the rights of purchasers and the public. Just in face of the expiration of the patent, its operations came to an end.

In 1820, steam power was in use; in 1822, it was largely employed, and machines were drawing together into factories. Everything combined to lead people in Nottingham and its neighbourhood to expect golden times, when the patent shackles should fall off. So, in 1823-4, capital was flowing in abundantly from lawyers, physicians, clergy, landlords, tenants, and traders, to create lace machinery. Every available smith and mechanic on the spot was hired, and to them were speedily attracted by the wonderful wages offered smiths and mechanics from far off towns. Day labourers came from the plough, and strikers from the forge. Clerkenwell watchmakers and Manchester engineers met on one common ground. Thousands of pounds were wasted in paying five to ten pounds a week in wages to people pretending to make machines, the movements of which they did not comprehend; and tens of thousands were drawn from speculators not in the trade, for machines which, if ever so well constructed, could not repay *them* their outlay. The demand for goods was, no doubt, immense, but prices necessarily fell. Enlarged consumption was met by still larger supplies. Both patentees and licensees had put into operation the most improved and speedy machinery in their power, and, of course, reaped the larger part of the harvest which accrued. The mania was called, "The Bobbin net fever." The inflation of mind was universal and complete. Nothing like it was ever seen in that trade before; and, unfortunately, the speculative frenzy of the nation, in 1825, had countenanced it. So, with the national collapse of 1826, came that of, miscalled, "Bobbin net prosperity," and a fearful one it was. Many lost all their means, and fell into hopeless poverty; others died, or went into self-imposed exile. The immigration had been for a time so great that Nottingham proper (always too densely populated) could not contain the people. The population burst its bounds, and so has continued to overflow ever since. In 1811, the numbers were 47,000; in 1856, 110,000, dwelling in the town and suburbs, an increase chiefly owing to the lace trade of which we are speaking. The circulation of money throughout the wholesale and retail trades of the town, was very much increased. Wages received by first-rate workmen were unexampled, and so was the thoughtlessness of too many. Journeymen rode on horseback to their workshops, and, having taken their shift at their machines, would daily refresh themselves with a pint of port or claret on their return. Some of these spendthrifts I have seen relieved at the parish pay-table twenty years ago; all, however, were by no means so unthrifty. One, who somewhat before that time began his mechanical course by mending his widowed mother's tea-kettle in a leisure factory hour, concluded his intelligent and indefatigable career in the Bobbin net trade, by purchasing, a few months since, for £60,000, a landed estate. No business has furnished more remarkable instances of success, and none of greater disappointments. Nevertheless, the working class has included every name I shall have mentioned in this paper. From these my own must not be excluded. From its beginning, and through every stage of its history, the men of the loom and of the forge have furnished the talent, the energy, the self-denial, which have been displayed; and have secured their share of the results in profit and the money capital of this remarkable trade.

Another proposed "mart" in 1826 did not come into operation. In 1828 the effort was again unsuccessful. But in place of it, a Committee of owners of machines and their delegates was constituted to regulate and control the working hours of the machines already in the trade, and to dissuade from constructing more. A restriction to twelve hours a day was carried out for the following ten months; and meantime, the owners of 3,307, out of the 3,842 machines, then found to be in the trade, signed a deed, binding those who signed it, that when the owners of seven-eighths of the machines had put their names to it, to obey the directions of the Committee constituted by it, and keep the working hours they agreed upon. But when the required number within fifty-five machines had been signed for, the dissidents amongst the owners of those unsigned for were found too important to be overlooked or trifled with. The restriction and the Committee were both given up. A memorial was signed by 1,808 journeymen in two hours in Nottingham, praying for continued restriction. From my position and in the hope of useful results, I was induced to occupy the chair of that Committee. It was a singular experiment, costly in labour and anxiety, though not in money, for it expended only £400. The machine owners had their profits raised £240,000 by that year's restriction. But this addition to their funds, ended in 650 new machines, of vastly better make and power, being added in that and the next year to the trade. One member of the Committee, himself very loud for the restriction, added forty-four machines to his lot, and of double power of production. They cost him £10,000. They were sold in the next trade panic for £600. Notwithstanding this experience, in 1834 and 1835 further bolstering of prices was attempted; but at that time and since these factitious plans have only had partial and brief operation. The great cost of the machinery, large profits, high wages, and rapid reduction in prices, may account for, but cannot justify these departures from the laws of demand and supply.

At this point of these historical remarks, it may be well to point out, that in 1816, the first machine (a traverse warp) was taken to France and set up at Douay, by Corbet, Black and Cutts for M. Thomassin. In 1817 Webster, Clark, and Bonniton, took a 36-inch (straight bolt) to Calais. Shortly after, Mr. Heathcoat introduced some into and constructed others at his factory at Paris, —since removed to St. Quintin. These were the adventurers who laid the first stones of the great structure which has since been raised in the North of France of this important trade. Mr. Delhaye, my fellowjuryman, in the Paris Exhibition, constructed, while a workman in Calais, the first French built machine. The Calais machines numbered in 1839, 705; 1834, 801; 1851, 603. Many have been replaced by wider and speedier ones. They had three pushers, fourteen traverse warps, 124 common circulars, 141 Jacquard circulars, and 321 levers. Calais has increased from 4,000 inhabitants in 1816, to 11,000 in 1851. Their lace business employs 50,000 females, besides the ordinary proportion of machine hands and attendants. There are 800 other machines; at Boulogne, St. Omer, Douay, Lille, St. Quintin, Caen, and Lyons. More expensive classes of goods are usually produced upon French machines than upon ours. Their fine yarns not being of equal quality to the English, forces them to purchase the latter largely. The English plain nets, which were formerly extensively smuggled into France, are now supplanted by their own; while they import into London their wrought laces and embroidered goods, and even some plain nets with advantage. They have applied the Jacquard apparatus to their machinery with much success; and of late years have ceased to copy Nottingham patterns, turning their own taste in designs to good use and profit.

There were at Brussels, in 1850, 16; Termonde, 8; at Malines, 5; at St. Josse, 4; in all, 34 machines in Belgium, chiefly making three twist Brussels net, upon which cushion flowers are applied. These are high priced articles when finished for the market, and justly of high repute. To dismiss foreign bobbin net machinery, there are, probably, in Switzerland, now 80; in Saxony, 70; Austria, 100; Prussia and Russia, 30; in Spain and other countries, 80; altogether 360.

The Nottingham trade had for some time cast an anxious eye upon the increase of French bobbin net machinery. In 1834, they prayed the Board of Trade to endeavour strenuously for commercial reciprocity with our neighbours. Dr. Bowring's mission failing, they tried hard, but unsuccessfully, to stop the export of Nottingham machinery. In 1841, they gave an unqualified dissent to the proposed free export of machinery. Government and Parliament were in its favour. All these exceptional plans for relief of trade, and protests against external one-sided competition, were unmistakable symptoms of surplus power of production in plain goods, which till then formed nearly the whole staple of the trade. Its safety depended upon getting the major part put upon producing fancy goods. I had taken the unusual step of compiling and publishing a census of the trade in 1831; again in 1833 again, in an equally elaborate form, I took a very minute one in 1836. The particulars thus made known were felt by many to be both striking and important.

I saw a machine for which Samuel Draper took out a patent in 1834 for drawing both his longitudinal and diagonal threads from separate bobbins, and operating upon each by a barrel organ. And again, in 1835, the patented machine, by the same man, for an application of Jacquard apparatus to a bobbin net machine. In this machine, Draper arranged to operate upon all the threads by individual action and selection. His system was not successful, and cost a large sum of money in the experiments. Draper took out, in 1837, a patent for Jacquarding the warp machine. Others have followed him successfully in both departments. He is living in deep poverty in Nottingham. All these and other plans having a similar object in view, falling under my eye, I wrote a fortnightly series of articles, from 1833 to 1836, urging through the local press the importance of fancy trade to Nottingham, the use of the Jacquard, and the necessity for a school of design. In 1841, Hooton Deverill patented the Jacquard application to the ends of bars placed in the machine. This great improvement was first made in the Levers' machine, by the purchasers of the patent-right, Messrs. Biddle and Birkin; and by others, since then, to the circular. It may now be said to have become general. A new development of the trade has taken place in consequence. The era of ornamenting lace upon the machine has certainly been ushered in; the results are new, startling, and of incalculable importance. Every fancy article, from the narrowed lace edging to the two-yard-wide store curtain, requiring some thousands of cards to complete the design, are now as much familiarised to our mechanicians, designers, and workpeople, as they were, twenty years ago, unthought of or unknown. The School of Design has been far more effective for good, in promoting knowledge of the principles of design, of taste, and its application to our peculiarly difficult fabrics, than I thought possible in so few years, when I first broached the proposition in the press of Nottingham. Our artizans, in particular, are not like the same class of men; and our embroiderers are equally impressed with the necessity for beautiful patterns. In these respects, the trade is undoubtedly placed on a more solid foundation than it ever was before.

Besides those already named as engaged in working out this fancy department mechanically I shall especially particularise three persons who each played an important part. John W. Bagley, a working shoemaker, unassisted, made himself so thoroughly acquainted with the principles of the bobbin-net machine as to produce any known mesh upon it. He first introduced extra guide-bars, and thus made honey-comb. This was a leading idea, developing other great results. By it he gained little, the trade very much. Bars to the number of 300 have since been made to act in one machine, and each under individual control. About 1837, he first saw real plat net—discovered it must be made by using a double warp—exclaimed "I have got it"—and in a few hours produced the mesh. For this plan Mr. Fisher gave him £100, and, on patenting it, liberty to use one license. This patent, taken out by Crofts in 1838, brought the patentees, it is said, a large yearly tribute for several years, besides the profit derived on their own numerous machines. A machine having £100 spent upon it in putting it upon this plat net frequently returned the outlay in a month. After some years, Bagley produced a perfect imitation of real Valenciennes narrow laces, scarcely to be distinguished from the hand-made article. Since then, he has succeeded in producing the texture and floral combinations of Honiton lace. For these, as exhibited in the Palais d'Industrie, 1855, I obtained from Jury 23, an unanimous allocation of the silver medal. It is a well earned reward, the only one his genius, labours, and sufferings have yet brought him. He can improve a bobbin-net machine, but not the opportunities it affords for making profit. With extraordinary talents, he is possibly as far from affluence as when he began thus to employ them.

To Mr. William Crofts, once one of the quickest and cleverest hands working in a Levers' frame, afterwards long connected with Mr. James Fisher, the trade is indebted for devising several important improvements of his own, and perfecting or bringing into successful operation those of others. In 1828, he arranged the "Levers" turnagain now in general use. He took out the "spotting" patent in 1833. Spotted goods are too beautiful and useful to go out of demand. There was one point, however, of great moment to the trade, which resulted from the numerous patents taken out by this gentleman and the great capitalist with whom he was connected, viz., the general disinclination to adapt machinery for fear of infringement. The patent of 1835, called, from its variety of claims, the "monster patent," required 49 sheets of drawings. I learn from Mr. B. Woodcroft that the 250 copies required for the Government publication of this patent will cost £250. When a society was formed in 1838 for mutual protection against actions for infringements, it was found Mr. Crofts had then about fifteen patents running; to these were to be added about forty unexpired, taken out by other parties. An action for infringement of Croft's plat patent was compromised in 1847, since which the trade has rested in quietude, and the mania for taking out patents has subsided into rationality.

About 1846, William Livesey, a person working a few machines on his own account, at Lenton, Nottingham, put on one for the purpose of making a straight down, looped, yet open and stout mesh, to be ornamented on the machine, with suitable patterns. Though not able fully to realise his design, yet it was not long before it was perfected, chiefly by the aid of Elsey, Sisling, and Cope. The Jacquard is applied to the back bobbin threads individually, and to the bars worked from the ends of the machine. By this machinery a new and important branch has been added to the Nottingham trade. One hundred and fifty wide machines are making large quantities of curtains, curtain nets, anti-maccassars, &c.; for such is the speed, that a pair of curtains four yards long, and each two yards wide, is produced in two hours. If, in addition to taste in design, the durable quality of this production is sustained, there can be no doubt it will take a permanent place in our trade. The size and conspicuous position when in use, of these articles, require energetic application of the art of design. As in the case of embroidered lace, &c., so in regard to this class, in order to advance true taste in the patterns produced, a small school of practical design is attached to each of the factories in question. The expense of each such school is about £1,000 per annum. The pair of curtains placed before you, is from such a school in the business of Messrs. Heymann and Co. The bed-cover required 13,000 cards, the weight of which is 1,000 lbs.

One of the follies, resulting probably from an unhappy tendency to follow in an unreasoning manner, the practice of some eminent name known in the trade as that of a successful man, and which has been practised in this trade to a greater extent than any other, I suppose, has been that of breaking up machinery, narrow and slow certainly, but otherwise useful. Mr. Heathcoat and one or two more have utilized these 8 qr. and 10 qr. machines, and to great profit. The rage has, however, been to build 16 qr. to 20 qr. of late years. I have an account of 3,000 machines, averaging nearly 7 qr. in width, sold in the eleven years, 1824 to 1835 inclusive. This body of machinery was, for original cost, ingenuity, and excellency of workmanship, such an one as was never before sold for old iron for £15,000, having cost £2,000,000 sterling. In 1824, a 7 qr. sold readily for £600; in 1835, such were cast out of top storey windows into the street, at the cry of, "Old rags and twist machines to sell." Many sold for £3 each, which, in 1836, would, by trifling adaptation, have repaid all charges, and put £100 into the owner's pocket by a month's employment. A 20 qr. 20 point, making "point" lace, cost the owner £3,000, it sold on his insolvency for £300. Fancy machines only numbered 200 in 1833, in 1836 were 1,250; in 1856 there are 2,150, including the most expensive (Levers) that are built, and which cost from £500 to £1,000 each. On these, silk laces are produced, having fining, thick threads, pearl, open works—everything finished upon the frame. A piece costing £50, has only the connecting threads to be drawn out, and it is ready for the market.

In 1831, embroidering and finishing of lace employed wholly, or in part, about 150,000 hands. They received wages £1,500,000 in the year. This fell, in 1833, to £550,000, and 55,000 hands; and, in 1836, to £350,000, and 35,000 hands. Including wages at the machines, as well as the subsequent processes, there has been paid to at least 130,000 hands, in 1856, £2,200,000 in wages alone, in this department of the Nottingham lace trade.

In conclusion, the manufacture of bobbin net lace by machinery is scarcely half a century old. The following will give an approximate idea of what in this brief interval it has become in this country:—

At several periods an account of the machines has been taken. In 1815 there were 140; 1820, 1,008; 1826, 2,469; 1831, 4,500, making a return of £3,417,000; 1833, 5,000, returning £2,620,000; 1836, 3,800, returning £2,212,000; 1844, 3,200, returning £2,995,000. In 1851 Mr. Birkin, reporting to Section 19 of the Great Exhibition, found 3,200 (34,382 quarters width) at work, returning £2,300,000, employing about £2,965,945 capital, and 133,015 hands. Capital in bobbin net machinery alone was estimated at £1,329,445.

In 1856 the machinery is increased to 3,500 (full 40,000 quarters in width), and greater power in production in the new ones. Also a far larger proportion is employed upon silk materials, and the number of frames making fancy goods forms now far the largest proportion. These changes will serve to account for the very large increase in the returns of the trade this year beyond 1850. 1,350 machines at least are rotary circulars, making plain goods by power in factories. At least 1,050 making fancies are worked by power, probably many more. About 2,158 machines in all, partly "Levers," partly circulars, some pushers, and some traverse warps, make fancy goods now. The materials are all imported, and cost on importation during the past year £920,000. The returns were £3,680,000, or thereabouts. This left for wages, interest, and profits, £2,760,000.

If to these figures be added the cost of raw materials (all imported) in the warp lace trade, £60,000, and the ultimate returns, £360,000, the result of the operations of the entire machine-wrought English lace trade will be:—Raw materials used, cost £980,000; total returns, £4,040,000; paid in wages, interest, wear and tear, and profits, £3,060,000. The entire number of hands employed may be stated at 135,000.

The trade was, until 1850 or thereabouts, cooped up in small unsightly workshops and warehouses, for the most part, but has been transferred, to a large extent, into some of the noblest buildings of which any manufacturing town can boast. Factories, dressing-rooms, and warehouses, are alike becoming spacious, airy, and, I trust, healthy; at least £250,000 has been expended within the last seven years in this class of improvements.

The torpidity of the home market during the last year, and the activity of demand abroad, has so changed the relative amounts of export and home consumption in lace goods, that it is not in my power to do more than indicate Germany, the United States, Canada, Australia, and the East Indies, as the principal markets for supplying foreign consumers with British machine-made lace.

This manufacture has always been exempt from the operation of the Factory Acts. Necessity for relays, arising from the unusual cost of the machinery, and the peculiar character of some of the operations, have been the chief reasons assigned.

There are no unemployed people in connection with this trade at this time, but rather a scarcity of workpeople in every department. Wages, therefore, have somewhat risen in general; for the labour of women and children considerably, during the winter and spring months. As the circumstances are exceptional in some degree, to attempt to give a scale of earnings would only be calculated to mislead. It is, however, gratifying to state, that the comfortable subsistence of the employed never was more easy nor more certain of attainment in Nottingham than at the present moment.

A large part of the work necessary to be performed in preparing all goods for the market is done at the dwellings of the people, thus affording domestic employment, paid for by the piece, to women and children, often such as from circumstances can only be partly engaged on such work. In these cases it comes in aid.

It is believed that the amount of infant labour performed in Nottingham has decreased for some years. It is still, however, an opprobrium, and ought not to exist, in connection with what is ordinarily a fair average rate of wages for adult labour.

On the whole, the people engaged in the trade we have been considering, are intelligent, active, independent, and respectable, as becomes those who have to meet the constantly varying requisitions made by a business which cannot sustain its present important position in the markets of the world, unless by the supply of articles distinguished for their soundness of quality, novelty, purity of taste in design, and skill in execution.

DISCUSSION.

The CHAIRMAN said, the hour warned them that they could not hope for much discussion on this interesting subject; but, whilst this was perhaps the longest paper of the session, it was certainly one of the most interesting; and at no period of the reading of it had the interest of the audience flagged. Mr. Felkin had brought forward a number of striking facts, which could not fail to have made a great impression on the minds of his hearers, but he had omitted one or two facts which had occured to him (the chairman), and which he would mention. Connected with the lace trade was the stocking trade, and in the Exhibition at Paris a mistake was made, by the French and foreign visitors taking the price of a dozen pairs of the Nottingham stockings as the price of a single pair. Nottingham manufactured stockings were shown at the Paris Exhibition from 2¾d. per pair and upwards, that was something like 3s. the dozen pairs; and such was the quality of those stockings that visitors, and, he believed, some of the trade, thought they were worth 3s. per pair, and it seemed almost fabulous that the price should be under 3d. A remarkable fact mentioned in the paper was, the great reduction which had taken place in the price of the bobbin net lace, viz., from 100s. per square yard to 6d. Coincident with this extraordinary reduction in the price of the material, was the fact that, from improved machinery and other circumstances, the people engaged in the manufacture of that article had increased in prosperity. He believed it was the case that, whilst this extraordinary economical fact was exhibited, the workpeople engaged in that trade had advanced in the scale of social comfort, and this extraordinary transition appeared to have benefitted alike the producer and the consumer. The paper had glanced at the improved comforts of the workpeople of Nottingham, and he (the chairman) could bear his testimony in saying that there was hardly any provincial town in England that was more rapidly acquiring an architecture of its own. These were most cheering facts, taken in connection with the production of articles of elegance, which were brought to a price within the means of all. How far the ladies would agree that the Nottingham machine-lace rivalled the more costly productions of Valenciennes, he could not say; and perhaps they had better not enter upon the question whether they thought it right to encumber their garments with innumerable yards of machine-wrought lace, as the ladies were in the habit of doing with the real Belgian and French laces, but he thought it probable that ladies might bring their minds to adopt the Nottingham lace, and that it would, to a certain extent, supplant the Valenciennes manufactures.

Mr. FELKIN.—Not supplant it. He believed there never was a period when pillow lace was more used than at the present time. Buckinghamshire suffered for a time; but the lace manufacture of that county was now in a better condition than it was previous to the introduction of the machine-wrought lace.

The CHAIRMAN added, that these were important facts to be reflected upon, inasmuch as they were apt to be apprehensive that progressive advantages operated unfavourably upon antecedent advantages. There was one point alluded to in the paper on which he felt great interest—that was the suggested establishment of a historical museum of the lace trade. They had evidence of a similar design in Manchester, where it was contemplated to collect the progressive memorials of the cotton trade by means of a museum, to represent the history of that branch of national industry. There were numerous other trades which might be represented in the same way; and he thought the time was coming when there would be a better appreciation of the interesting records of the past; and, looking to the future, they might hope for the establishment of a trade museum, which this Society had greatly aided in commencing. Such a museum, he thought, this country, of all others, ought to possess; and yet, up to this time, they had been the most backward in that respect of any nation. They were too much addicted, he thought, to the notion that every one must do his own work as he pleased, rather than associate for the purposes of grand and combined undertakings. He thought that national principle—so to term it—was carried a little too far; and he thought some relaxation in this respect would be alike advantageous to individuals and the community at large; by which means they would be enabled to rival the magnificent productions of science and art displayed in other countries, where there was for this purpose a somewhat more despotic action than they had in this country. He hoped the time was coming when they would have an historical museum, representing not only the lace trade, but also all the other manufactures of the country. It now only remained for him to call upon some gentleman to propose a vote of thanks to Mr. Felkin for his valuable and interesting paper; and he thought he could not do better than request that task to be undertaken by the Rev. Mr. Rigg, of Chester, who deeply sympathised with the efforts of the Nottingham lacemaker, and with the admirable way in which their labours had been recorded by Mr. Felkin.

The Rev. Mr. RIGG said, he had attended merely as a listener, without any intention of offering any observation upon a subject which he had heard with so much interest. Much valuable instruction might be gathered from this paper, and perhaps no one was more competent than Mr. Felkin to deal with the difficulties of those inventors who had been described as displaying "much genius and little science." Hence the production of machines, wonderful in their construction, but useless, in consequence of the extraordinary ingenuity displayed upon them. The consequence was, they had the tailor, the shoemaker, the publican, and the butcher, all engaged in the invention of this machinery. He thought, if there was one duty which it was more incumbent upon the government to discharge than another, it was to afford to those self-taught men the means of promoting their scientific instruction. Had that been the case they would not have the fact recorded, that they had done much for the trade, whilst they themselves were involved in poverty and want—occupying a pauper's grave, while all around had been benefited by their ingenuity and talent. Had the men who invented these various machines had the same means of obtaining a knowledge of science as they had for improvement in design, no doubt the machinery itself might have been greatly simplified, and, consequently, less capital would have been involved. They might have had equally good productions at still more extraordinarily low prices. Unless they promoted the scientific education of the people, they must expect to be left behind in the race of competition. The Schools of Art in the present day were doing all that could be expected of them, and if they would do as much for promoting the study of science as had been done in the study of design, Nottingham and Manchester would be amongst the first places to be benefitted. He begged to propose a vote of thanks to Mr. Felkin for his valuable and instructive paper, and expressed a hope that that gentleman would favour the Society on a future occasion with further details of the progressive history of this branch of national industry.

The vote of thanks having been unanimously accorded,

Mr. FELKIN, in acknowledging the vote of thanks, expressed his willingness to communicate all he could to the Society, and, through its publications, to the world at large, as to what was transpiring in Nottingham with regard to its staple manufacture. He felt very grateful to the meeting for the patience with which they had listened to details, dry in themselves, but still he hoped not devoid of interest to those who were acquainted with the labour and burdens which had attended the progress of the lace manufacture. Competition was daily increasing, and demanded the utmost energy on the part of those who wished to make their way successfully. The little trifling piece of lace he held in his hand cost a man's life. Having succeeded in producing it, the poor man hung himself as the consequence of an overwrought mind. They little knew of the wear and tear of the human mind attendant upon even partial success in the construction of such machinery as they saw before them, whilst failure often led to ruin and despair. This was a proof of the necessity for scientific as well as artistic progress in manufactures. Had scientific instruction been carried to the extent desired by Mr. Rigg, in Nottingham, Mr. Heathcoat would not have put 60 motions in his machine when six would answer all the purposes required, but he would have been aware of the readiest mode of applying the materials which he found or invented. It had been so in the history of all self-instructed mechanicians, who had too often gone over the same ground as had been unsuccessfully travelled by those who sought to improve machinery. What had been the result? An enormous outlay of capital in the shape of perfectly useless patents—worse than useless—for they often stood in the way of the free use of the mind, and hands, and capital of those engaged in the trade. A proper education as to the best methods of applying machinery would have resulted in the saving of hundreds of thousands of pounds in Nottingham alone during the last few years. He was, however, gratified with the hope that the town he represented on this occasion had not come out of his hands in a worse condition than it was previously to his obtruding this paper upon the attention of the Society.

The Secretary announced that the Paper to be read on the evening of Wednesday next, the 4th of June was " On Brickmaking by Machinery," by Mr. Humphrey Chamberlain."

STATE AID IN FORMING LOCAL MUSEUMS OF ART.

A change has been made recently in the mode of examining the works of the Schools of Art, which is of a self-acting character, and calculated to assist materially in forming local Museums of Art. Heretofore, there have been two annual exhibitions in London for the purpose of inspecting the works and rewarding the students of the metropolitan and provincial schools. This course was attended with two defects—1st, *all* the works of the various schools were never inspected together; and 2ndly, there was no sufficient mode of testing the student's knowledge of geometry, mechanical drawing, perspective, and model drawing. Moreover, the great increase of Schools of Art throughout the kingdom, and also the number of students attending them, necessitate changes in the mode of inspection. It has been determined, therefore, that once in each year an inspector from the department shall visit each School of Art, and shall hold an examination in certain of the early stages of the course; and at the same time, in conjunction with the head-master of the school, and assisted, if necessary, by a head-master from one of the nearest Schools of Arts, adjudge local medals and rewards. The principal and advanced works rewarded with a medal, will be sent to form a general or national collective exhibition, either in some one of the great provincial towns, or the metropolis; and will be inspected by the art superintendent, who, in concert with examiners appointed by the board, will adjudge national medals to the best works from all schools in competition with each other. The collection will afterwards be sent round to some of the larger provincial towns. The whole number of local medals that can be awarded in any school will not exceed thirty, and in any one stage or section may not exceed three. The works which have obtained first medals in the local competitions, being all collectively exhibited, will be examined by the art superintendent, aided by other appointed examiners, and medals awarded to the works successful in this second competition. These medals can in no case exceed 100 in number for all the schools for the year 1856-7, but the number up to this maximum will be regulated by the excellence of the collective works. For every medal awarded in the NATIONAL competition, the School of Art in which the successful student who obtained the medal was under instruction, will have the privilege of selecting from a list, works of art of the value of £10. The result to every school will, therefore, be proportioned to the advance of the students, and it will be by such means that the nucleus of a local museum may be established.

The feature of this plan is, that each local school shares in the distribution of state assistance, absolutely according to merits. The central authority, instead of assuming the position of being the judge of the amount of assistance, as formerly, will now become merely the executive of the self-acting demands of each local school.

Home Correspondence.

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TONNAGE REGISTRATION.

Woolwich Dockyard, 27th May, 1856.

SIR,—I request the favour of your inserting, in the *Journal of the Society of Arts*, the following communication, which I have addressed to the Editor of the *Mechanics' Magazine*, in reply to a critique which has appeared in Nos. 1,705-6-7-8-10 of the *Mechanics' Magazine*, on my paper on Tonnage Registration, read before the Society of Arts on the 16th January last.

I am, &c.,
CHARLES ATHERTON.

To the Editor of the " Mechanics' Magazine."

Woolwich Dockyard, 27th May, 1856.

SIR,—My attention having been directed to the *Mechanics' Magazine*, Nos. 1,705-6-7-8-10, containing a review of the paper on " Tonnage Registration," read by me before the Society of Arts, London, on the 16th

January last, I am glad to find that you regard the subject worthy of being brought before the attention of the numerous readers of the *Mechanics' Magazine;* indeed, there can be no question that the public generally, who, as consumers, pay the whole cost of production and delivery of the goods consumed, including freight and maritime insurance (the value insured being said to be no less than 600 millions per annum), are deeply interested in shipping registration being made duly effective for promoting safety at sea, and all other objects, both mercantile and scientific, conducive to maritime transport economy.

With reference to my paper on "Tonnage Registration," as published in the *Journal of the Society of Arts* for the 18th January, 1856, but which I regret did not appear in the *Mechanics' Magazine* previously to the publication of your review thereon, the first point now requiring attention on my part is to disabuse the minds of your readers as to the inferences and gratuitously assumed conclusions which your review, in common with others who have taken part in this discussion, have been pleased to represent as the purport of my paper; hence, misstating my case, and attributing conclusions to me which I disavow. For instance, by my paper I did not object to internal roomage as one element of tonnage registration; but I upheld it as indispensable to a complete system of registration, suggesting, however, in addition, that shipping registration ought to record the capability of ships for carrying weight of cargo with reference to some *limitation* of draught, and that the actual draught at which ships leave port ought to be officially recorded, for the purpose of affording some check on the overloading of ships, by rendering legal proof on this vital point available in the case of judicial inquiry as to the cause of wreck and loss of life, or damage to property at sea. These are the suggestions which constitute substantially the sum total of my imputed "condemnatory harangue" against the Merchant Shipping Law of "1854." It has been to gloss over my expositions of these deficiencies of the law, and thus counteract the proposed amendment of the law, that I am dignified as the Coryphœus of agitators against the law. This, in reality, is Mr. Atherton's "attack on the shipping interest, which has given such dire offence;" but I beg to apprise the readers of your review that I regard all the imputed personalities which have been laid to my charge as mere delusion, put forth to divert attention from my exposition of the fact that our present system of shipping registration affords no certain or even comparative measure of the tons weight of cargo that ships will safely carry; nor does it afford any direct check to the unsafe loading of ships, or prescribe that any official record be taken of the draught at which ships leave port, to be received as evidence in the case of judicial inquiry as to the cause of wreck or damage of cargo at sea. Such are the deficiencies of the Act of "1854;" and if a law be not effective for the checking of abuse, it is sure to be effective for the cloaking of abuse, and, consequently, conducive to the propagation of abuse; and these, I maintain, are the characteristic features of the Merchant Shipping Act of 1854, as respects Part 2, on the measurement and registration of shipping. Again, in judging of my expressions with respect to their personal application, some attention ought to be paid to the distinction whether I am the originator of an argument, or the constrained respondent to an argument. Be it observed, that in bringing forward the question of Tonnage Registration before the Society of Arts, I did not originate, but I had to meet, the argument which had been previously advanced in support of the Merchant Shipping Act of "1854," to the effect that that Act ought not to be questioned or impugned, because the shipping interests had declared themselves satisfied with the Act as it is, and had not put forward any petition to the legislature for the amendment of the tonnage registration clauses. It was to meet this singular doctrine—most convenient as respects class legislation once achieved, but monstrous as respects permanent public interests—that I challenged precedents, in language which your review is pleased to compliment (p. 343) as "Mr. Atherton's indignant eloquence, all very fine, but quite beside the question," to refute the allegation that no chartered institution, public trust, or corporate body of any kind, whether political, mercantile, or professional, has ever yet been known, voluntarily, to originate self-corrective reformation, at a sacrifice to its own exclusive and once legalised or prescriptively usurped immunities, privileges, powers, or profits, purely for the sake of public good. Hence, I ventured to remark that we have no right to expect that the shipping interests should, in these days, and as times go, all at once become purists *par excellence,* and constitute themselves the exception to the general rule. Here was an insult to the shipping interests! How have I in consequence been charged with slander, and put on my defence! But I need not further plead my own cause, for your review itself briefly sums up this little episode in the following words, page 340:—

"Mr. Atherton's assault provoked one or two replies from shipowners, who felt their craft insulted by some of his remarks, showing a sensibility on the occasion which would go far with some people to prove the truth of those imputations they are so ready to extract from Mr. Atherton's words." Your review further observes, page 342, "We do not think Mr. Atherton meant to make any serious charge against the shipping interests." I thank your review for this remark, as showing your own impressions on reading my paper, but I cannot accept the proffered defence as to my not having *meant* to make any serious charge, and offer so meagre an apology, if any be due, for I always try to write as nearly as may be what I mean. I deny *in toto* that my writing admits of any personally offensive construction. I addressed myself to a system of public registration, which I regard not merely as deficient for good purposes, but delusive and mischievous in its immediate effects on public interests, and I denounced it as such; but immediately on finding that my exposition of the deficiences of our system of tonnage registration had been diverted into a charge of personal defamation, I took an early opportunity in the course of this discussion of publishing as follows:—

"Can it be said that there is any sentence in my paper unbecoming, and not fairly within the bounds of argumentative propriety? If such be the opinion of the Council of the Society of Arts, or of the Chairman of the meeting at which my paper was read, I regret it, and I claim the privilege of retracting it." Here, again, I meant what I wrote.

Now to return to our subject.

In suggesting that Tonnage Registration ought to embrace the capabilities of ships respectively for carrying weight of cargo as distinguished from roomage for cargo, I anticipated being met by that hackneyed argumentative stopper, "Impossible!" by remarking that the capability of a ship for carrying weight would be deducible from the displacement contained between the actual water-line, or plane of flotation of the ship when light, ready to receive her cargo, as given by the ship herself, and the load-line limit of draught for which the ship may have been designed by its constructor, or which may be officially assigned to her, showing also, at the same time, by reference to the catalogues in Fincham's Naval Architecture, pages 248, 267, 321 to 327, and 405 to 410, that ships of all classes, both naval and mercantile, sailing ships and steamers, are constructed, and their capabilities for carrying weight are calculated by British, French, Russian, and Swedish shipbuilders with reference to a determinate deep draught line, which limit of draught or load line is, in the hundreds of ships tabulated by Fincham, specified and recorded in feet and inches fore and aft as the contemplated limit of the loading. Still this reference to, and recital of, Fincham's catalogues in proof of the practicability of officially assigning a load-line limit to every ship, is quietly ignored by all who have taken part in this discussion. Fincham's catalogues, though thus pointedly adduced by me, are not even noticed in your review of my paper, and thus the suggestion for registration of the capabilities of ships for carrying weight with reference to the deep draught limit assigned by the constructor, has (Fincham's catalogues notwithstanding) been simply denounced by some as "impossible," and avoided by others with silence.

Your review is, however, constrained to acknowledge, and at the same time to palliate, the fact of the insufficiency of the law of 1854, in the following terms (page 341):—

"The tonnage measurement and registration of vessels has never been fairly brought before government in any other than a purely fiscal point of view. Mr. Atherton is the first agitator that we know of who has insisted upon the scientific features of the case, and those which bear upon the dangers of the sea voyage."

Again, at page 343, your review admits as follows:—

"Undoubtedly it would be very desirable, if possible, to fix a limit to the degree to which ships may be loaded."

And again:—

"There is undoubtedly a point beyond which ships cannot be safely loaded."

These acknowledgments completely establish the fact of the existing deficiencies of the law on which I have based my paper and suggested specific remedies. Your review admits the grounds on which "Coryphæus" the agitator has based his "condemnatory harangue;" and although your review sets up the defence that "the tonnage measurement and registration of vessels has never been fairly brought before Government in any other than a purely fiscal point of view," you all at once abandon that explanation, and affirm that the system of admeasurement prescribed by the Act does effect all the objects of complete registration, for, at page 342, we read as follows:—

"Of this, however, we are satisfied that if a shipowner stipulate for a ship whose registered tonnage shall be 1,000, he need be under no apprehension as to its capabilities of carrying 1,000 tons weight or 1,000 tons of measurement of light cargo at the usual conventional measurement of 40 cubic feet to a ton."

Now, on this point, I join issue with your review. My challenge of the registration is this, that internal roomage, measuring, as prescribed by the Act of 1854, up to the deck, without reference to any plane of flotation at which the ship may put to sea, affords no guarantee or measure as to the actual or even to the proportional tons weight of cargo that ships as floating vessels, not submerged catamarans, will carry. Some ships of 1,000 tons register, that is 100,000 cubic feet internal roomage, may safely, so far as flotation is concerned, be loaded with 1,500 tons weight of cargo, and in addition thereto 1,500 tons by measurement of light cargo at 40 cubic feet to a ton, being altogether 3,000 tons of cargo or three times the amount of the register tonnage chargeable for freight, whilst other ships of 1,000 tons register may be loaded to the utmost limit of safety with only 500 tons of cargo on board or only half the register tonnage. As for steamers, I see no limit to the possible ratio between their register tonnage and their capability for weight cargo. Thus we may have two ships of the same register tonnage, say 1,000 tons, one of them may be loaded with 3,000 tons of mixed cargo for freight, whilst the other may not be capable of safely carrying more than 500 tons weight of cargo, yet your review informs us (No. 1706, page 368) that the present system of tonnage registration has been "enacted with the sole view of levying tolls fairly." Your review calls upon me to name the ships that will substantiate my statements. I decline thus to show up the shipping of any individual, and I should have supposed that the case of the *John*, with which in this discussion I was so perseveringly taunted, might have satisfied you as to the unfairness of thus tampering with private interests in matters of public discussion. Shipowners have a just right to keep to themselves, if they so please, all the mysteries of their craft not exacted of them by the requirements of the law; but if your review be over-exacting in this subject, the records of the transport service during the late war will doubtless afford much statistical information on this subject. The obvious explanation of the above asserted discrepancies is that ships cannot be immersed up to the very deck to which the registered tonnage is measured, and thus put to sea with the deck awash in smooth water. Ships at sea are commonly liable to lie over as much as 30°. I do not pretend to dictate the maximum or minimum angle for which provision should be made. If, however, we assume not 30° but 18° only as the maximum safe lie-over of the ship, then in this case the load line limit of the ship in smooth water would be at the distance of one-sixth part of the beam below the deck amidships, and the number of tons weight, including the weight of the ship itself and its equipment, that would be required to immerse the ship down to this assumed load-line, namely, one-sixth part of the beam below the deck, will depend on the proportion which the *immersed* portion of the ship bears to the portion not immersed, that is, on the proportions of length, breadth, and depth and character of the lines to which the ship of, say a 1,000 tons register, may have been constructed. In fact, the principle of basing tonnage admeasurement on the entire internal roomage, measuring up to the deck, above the plane of flotation at which vessels can safely go to sea, does not fulfil the conditions set forth by your review in the quotation above referred to as guaranteeing any definite capability for carrying weight based on the register tonnage. The doctrine thus asserted by your review, namely, that the displacement or capability of ships for weignt-cargo is closely proportional to their internal roomage, is based, in the first place, on the untenable assumption of a proportional scale of scantling, or build; and even in the case of proportional build, it only holds good with ships sunk or water-logged, deck awash, full, may be, of dead men's bones—a precious condition of things for constituting the only base of tonnage registration—a precious price at which to purchase the equity in levying tolls before referred to, possibly liable to vary, in ships of the same registered tonnage, in the proportion of thirty to five, if charged against their tonnage of freight cargo.

As regards the practical operation of this new system of tonnage admeasurement tending, as your review asserts, to remove the obstacles to improvement which existed under the old system of builders' measurement, all the evils of which system your review is pleased to say would be continued by adopting the system of registration suggested by my paper, I beg to observe, in the first place, that my proposed system of tonnage admeasurement and registration does not supersede the internal measurement prescribed by the law of "1854," and which your review holds up as the panacea of all evils, but adopts it as giving the capability of ships for carrying a definite quantity by measure, provided that the said quantity be not so heavy as to sink the ship, and, to check the occurrence of such a catastrophe, I propose that the registration embrace the capability of the ship for carrying weight; and to prevent abuse in this respect, in defiance of the registration, I have suggested that the draught at which ships leave port be officially recorded by some person not interested in the loading of the ship. How these additions to our registration can mar or neutralise the efficacy which your review attaches to the roomage registration alone, I cannot discern. I, however, do perceive that this system of registration and record, so "un-English, tyrannical, and inquisitorial," would afford evidence whereby the cause of wreck might be judicially scrutinised more closely than is possible under the restricted registration prescribed by the Act of "1854," especially as respects the question, whether such wreck may be attributable to causes for which the owners or charterers may be held pecuniarily responsible, or to causes for which the parties in charge of navigating the ship are responsible by imprisonment, or such-like non-pecuniary but personal punishment. What signify penalties imposed by law on proof of fault, if the same law, by the insufficiency of its enactments, obstructs all proof, as is the case with the Merchant Shipping Act of "1854," touching the loading of ships. On this point, also, your review, although verbosely condemnatory of my paper, is constrained to make the following concession (page 343):—

"In case of accident, and the consequent inquires instituted by the Board of Trade, the circumstance [overloading] proved legally in evidence by persons conversant in these matters, should have its due weight, and remove the accident from the category of those over which the owners have no control. Let the Board of Trade have, if it so please, properly authorised officers to note and record these facts."

Coming events cast their shadows before.

Now, really, after these concessions on the part of your review, so substantially confirmatory of my paper, I may leave to be disposed of by the winds all the mere assertions and utterly unfounded and inapplicable popular plausibilities about the baneful effects of government interference, which constitute so large a portion of your review, as published in Nos. 1705 and 1706 of the *Mechanics' Magazine.*

I will, however, add a few words on the type of ships, as affected by the law, and also dispose of the measurement or mode of measurement question to which your review has so copiously directed attention in Nos. 1707, 1708, and 1710 of the *Mechanics' Magazine.*

On the type of ships as affected by the law of admeasurement, it is questionable whether the admitted improved type of shipping, which of late years has been gradually introduced, is attributable to any changes which have been made in the law of Tonnage Admeasurement and Registration. So far as the builders were concerned, their pecuniary interest was, under the old law, decidedly opposed to the production of the deep and bluff type that formerly prevailed, for by the old law of tonnage measurement the builder's payment was based on length and midship breadth only; his interest, therefore, was to build as shallow and as sharp a ship as he could induce the shipowner to accept, but the interest of the shipowner, on the contrary, was to get as burthensome a ship as he could for his money, or a ship deep and bluff, so as to carry a large cargo in proportion to the nominal tonnage. Thus, under the old law the interest of the builder was in opposition to the production of the old deep and bluff type. The cupidity of shipowners thus to retain control over the builders, and get an indefinitely burthensome ship under a limited nominal tonnage, has been one of the causes why the old law of builders' tonnage, which was repealed in 1833, has continued up to the present time (1856) to be generally upheld as the base of building contracts. Of late years, however, competition in trade, especially as respects steamers *versus* sailing vessels, has enforced an improved type of build; but if the register tonnage based on internal measurement under the law of 1854 should now be recognised as the base of building contracts, it will then only be by the deep loading of ships, thus encroaching on safety, that the cupidity of shipowners and ship-charterers to carry the heaviest possible cargo in proportion to the registered tonnage will be gratified. Hence the necessity for registering the limitation of weight which the loading ought not to exceed.

As respects the *mode* of measurement, I regard this as a question of detail, and I have already published my views thereon, as follow:—

"I do not take credit to myself for having devised any new mode of admeasurement; I have merely suggested that as ship-builders generally object to their lines being taken off, and their peculiar type of form ascertained in a manner which admits of its being appropriated or pirated by others, as is done in the system of measurement prescribed by the law of 1854, if these objections on the part of builders be held to be reasonable, I have suggested that we may approximate very closely to the required cubical capacities of ships, both externally and internally, by adopting the principle of the French system, namely, taking cognisance of the three dimensions, length, breadth, and depth, and correcting the cubical product by a factor, the said factor to be either a medium constant quantity, or be subjected to a prescribed scale of variation to meet extreme cases as may be determined. If, however, the objections of builders to the exact taking off the lines of their ships be overruled for the public good in this case, I do not hesitate to bring before the notice of any committee that may be appointed to investigate this question, that the system of shipping admeasurement originally adopted in 1829 by Mr. James Peake, a shipwright officer in her Majesty's service, and practised by him since that date, is a system preferable to that which is prescribed under the Act of 1854. Any two really scientific systems of admeasurement, such as Sterling's rule and Peake's rule, will produce closely identical results. It, is, therefore, not so much on the score of superior accuracy as on the score of superior applicability and facility of being mentally understood by the operator, that Peake's system is to be preferred."

As regards Peake's rule, it includes a closely approximate measurement of the curved spaces, whether convex or concave, by which the real form of a ship between the extremities of the ordinates of measurement differ from the straight line, whereas, by Sterling's rule no notice whatever is taken of the curved portions above referred to; Peake's system is, therefore, the more correct of the two. A further advantage of Peake's rule is that the sections of the vessel may be taken at any parts most conveniently accessible, and not necessarily equidistant; whereas, by Sterling's rule it is essential that the ordinates of the respective sections be equidistant, and that the sections themselves be equidistant from each other.

In regard to Sterling's rule, as your review in Nos. 1,707, 1,708, and 1,710 of the *Mechanics' Magazine* elaborately expounds the *rationale* of Sterling's rule, for the edification of the numerous readers of that useful and deservedly popular periodical, arriving at the following conclusion:—"The wonder is, that a rule for the calculation of the cubical contents of an irregular solid is capable of so satisfactory and simple explanation;" and as I have no more desire to depreciate Sterling's rule than I have to depreciate any other mathematical exposition, I will not say one word in question of the congratulation with which your review greets the readers of the *Mechanics' Magazine* on the subject of your exposition of Sterling's rule as the base of the rule for tonnage measurement under the Act of 1854.

The modes of approximately measuring a ship admit of several variations; but I regard the mode of measurement as a mere matter of detail, not affecting the vitals of the Act of "1854," although it is the point to which your review, after having substantially admitted the deficiencies of the law which constitute the subject matter of my exposition, has almost exclusively directed attention, in Nos. 1,705-6-7-8-10, of the *Mechanics' Magazine.*

I am, &c.,
CHARLES ATHERTON.

Proceedings of Institutions.

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Blackburn.—From the thirteenth annual report of the Directors of the Literary, Scientific, and Mechanics' Institution, it appears that the number of members has varied considerably during the four quarters, having been respectively, 420, 398, 474, and 452. The attendance upon the various classes is stated to have been, on the whole, highly satisfactory. The numbers in each during the last quarter were: Writing and arithmetic, 113; grammar, 51; reading, 62; geography, 39; female class, 10. It is in contemplation to establish a drawing class. During the season sixteen gratuitous lectures were delivered, and the Directors congratulate the members on their success. The reading-room is amply supplied with various daily and weekly newspapers, as well as serials. Owing to a handsome balance at the end of the last year, the Directors have been enabled to add 1,065 volumes to the library by purchase, and 50 volumes have been presented. The number of volumes taken out for reading during the four quarters has been as follows, 865, 1008, 1901, and 2350, making a total of 6,124. The number of readers has been 208, 216, 291, and 306. The subscriptions during the year amounted to £281 5s. 6d.; other receipts to £15 6s. 8d. There is a balance in hand of £94 3s. 8d.

Kendal.—The thirty-second annual report of the Mechanics' Institute states that a large increase has taken place in the attendance at the news-room, and the loans from the library have amounted to 1,987 volumes, being an increase of one-tenth over those of last year. There have been added to the library during the year 24 volumes, 19 by purchase and 5 by donation. The number of members and subscribers now amounts to 136. The report refers to an excursion trip to Lancaster and Furness Abbey, of which about 170 members and friends availed themselves. It then speaks of a *soirée* held in the winter, which was not numerously attended, and says that various causes conspired to prevent the arranging of a winter course of lectures, as in former years. The endeavours of the committee have been diligently turned to the establishment of classes; that for French continues to make steady progress. The drawing class numbers 10 members, and the teacher reports very favourably of their progress.

Yeovil.—The annual report of the committee of management of the Mutual Improvement Society states that since the last meeting they have been engaged in raising funds for purchasing a new building. It seems that £464 3s. 0d. has been raised by donations, and £400 by £5 shares, the latter secured on mortgage of the building, at 5 per cent. interest. The number of members has increased from 207 to 454, and the issues from the library from 616 to 1,873. The library has been increased by the purchase of 58 volumes, and 34 volumes by donation. During the winter a lecture was delivered every week, and the result was in every respect satisfactory.

To Correspondents.

Erratum.—In last No., p. 460, col. 2, line 16 from bottom, for Bentley, *Richard*, read Bentley, *Professor Robert.*

Letters have been received from Mr. F. Braithwaite and Mr. S. C. Homersham, on the Water Question, but their publication is unavoidably deferred for want of space.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 10*th*, 15*th*, 16*th*, 17*th*, *and* 19*th May*, 1856.

Par. No.
160. Naval and Military Accounts— Reports and Treasury Minutes
193. Thames Embankment, &c.—Copy of Reports.
201. Fire Insurance—Account.
217. New Churches—Account.
196. Mercantile Marine Fund—Account.
189. Exchequer—Account.
205. Commissariat Chest—Account.
170. Turnpike Trusts (Ireland)—Statements of Income and Expenditure.
200. Loan Societies—Abstract of Accounts.
202. Poor Law—Copies of Report and Correspondence.
214. Spirits—Returns.
168. East India (Revenues)—Account.
120. Bills—Court of Exchequer (Scotland).
126. Bills—Registration of Voters (Scotland).
132. Bills—Registration of Leases (Scotland).
Railways (Number of Passengers)—Return.
Turnpike Trusts—6th Report by the Secretary of State.

Delivered on 20*th May*, 1856.

122. Shipping—Returns.
181. Mr. Brownrigg—Copies of Additional Despatches.
194. Coals, Cinders, and Culm, &c.—Account.
110. Bill—Grand Juries (Ireland).
Oude—Papers relating to.

Delivered on 21*st May*, 1856.

90. Civil Services Estimates—General Abstract.
210. Foreign Sugar—Account.
212. Poor Law—Return.
223. Civil Services Estimates—Class 8.

Delivered on 22*nd May*, 1856.

212. Poor Law—Return (a Corrected Leaf).
133. Bill—Juvenile Offenders (Ireland) (Amended).

Delivered on 23*rd May*, 1856.

229. Fireworks, Hyde-park, &c.)—Copy of Correspondence.)
134. Bills—Dissenters' Marriages (as Amended in Committee, on Re-Commitment, and on Second Re-Commitment.)
136. Joint-Stock Companies Winding-up Acts Amendment.

Delivered on 24*th and* 26*th May*, 1856.

198. Ordnance Survey of Scotland—Report from Committee.
224. British Spirits—Return.
206. Public Prosecutors—Report from the Committee.
221. Public Libraries—Returns.
211. Statute Law Commission—Copy of the Memorandum of the Attorney-General.
225. Foreign Shipping—Account.
226. Army—Return.
227. Mortars and Guns—Return.
174. Ecclesiastical Commission—First Report from the Committee.
122. Bills—Judicial Procedure, &c. (Scotland).
131. Bills—Courts of Common Law (Ireland) (as Amended in Committee, and on Re-commitment).

MEETINGS FOR THE ENSUING WEEK.

Mon. Royal Inst., 2, General Monthly Meeting.
Architects, 8, Mr. R. Dennis Chantrell, "On the Domestic Brick Buildings of the Sixteenth Century in Bruges and other places in Belgium."
Chemical, 8, 1. Mr. R. Adie, "On some Experiments with Thermo-Electric Joints." 2. Mr. F. Field, "On the Action of Heat upon Oxichloride of Copper." 3. Professor Abel, "On the Composition of some Foreign Varieties of Iron."
Entomological, 8.
Tues. Royal Inst., 3, Mr. T. A. Malone, "On Photography."
Linnean, 8.
Wed. London Inst., 3, Professor Rymer Jones, "On Entomology, and the General Organisation and Metamorphoses of Insects."
Society of Arts, 8, Mr. Humphrey Chamberlain, "On the Manufacture of Bricks by Machinery."
Geological, 8, 1. Mr. Plant, "On the Keuper of Leicester." 2. The Rev. Mr. Brodie, "On the Keuper of Warwick." 3. Mr. Salter, "On Diploceras, a new Genus of Cephalopoda." 4. Mr. Woodward, "On an Orthoceras, from China."
Thurs. Royal Inst., 3, Prof. Tyndall, "On Light."
Zoological, 3.
Antiquaries, 8.
Photographic, 8.
Fri. Botanical, 8.
Royal Inst., 8½, Prof. Tyndall, "Comparative View of the Cleavage of Crystals and Slate Rocks."
Sat. Asiatic, 2.
Royal Inst., 3, "Dr. A. W. Hofmann, "On the Non-Metallic Elements, their Manufacture and Application."
Royal Botanic, 3¾.
Asiatic, 8½, Lieut.-Gen. Briggs, "On the Organisation of the Armies of India under the Native Princes."

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette May* 23*rd*, 1856.]

Dated 4*th April*, 1856.

820. Joseph Gilbert Martien, Newark, New Jersey, U.S.—Improvements in the manufacture of iron.

Dated 24*th April*, 1856.

980. Alexander Southwood Stocker, 11, Poultry, Cheapside—Improvements in the application of certain materials to the manufacture of ink and other stands, and other articles, and in the manufacture and finishing of articles produced out of such or other material or materials.

Dated 25*th April*, 1856.

992. George Elliot and William Watson Pattinson, Newcastle-on-Tyne—Improvements in the production of peroxide of manganese.

Dated 7*th May*, 1856.

1069. John Furnevall, Haslingden—Improvements in the construction of valves.

1070. George Martin, 6, Windmill-terrace, Camberwell, and Alfred Lodwick Newman, New Church-street, Bermondsey—Improvements in freeing or purifying animal fibres from admixture with vegetable matters.
1071. William Joseph Curtis, 1, Sebbon-street, Islington—Improvements in carriages to run on rail or tramways and common roads.
1072. Ralph Heaton, jun., Harry Heaton, and George Heaton, Birmingham—Improved manufacture of balance weights used for counterbalancing pendant lamps and chandeliers, and for other like purposes.
1073. Samuel Alexander Bell and John Black, Bow-lane—Improved method of, and preparation for, igniting matches.
1074. Jean Périnaud, Paris—Improvements in preparing or dressing silks.
1075. Robert Royds, Southampton—Improvements in the manufacture of soap.

Dated 8*th May*, 1856.

1076. Louis Guillaume Perreaux, 16, Rue M. le Prince, Paris—Improved valve.
1077. Charles Schneider and Frederick Leiss, Hesse Darmstadt—Manufacturing a safety boiling apparatus.
1078. Louis Fréderic Mayer, 133, Regent-street—Improvements in photography.
1079. Alexander Ebenezer Riddle, 33, Walbrook, and Isaac Hoare Boyd, 3½, Mansion-house-place—Improvements in tanning by machinery and chemicals. (A communication.)
1080. James Niven, Keir, N.B.—Improvements in the manufacture of paper, and in the production of textile materials.
1081. James Gray Lawrie, Glasgow—Improvements in steam engines.
1082. Jonathan Amory, Boston, U.S.—Improvements in furnaces for locomotive and other steam boilers, which improvements are applicable to reverberatory and puddling furnaces, and to furnaces for heating buildings.
1083. Conrad William Finzel, Bristol, William Needham, Smallbury-green, Middlesex, and John Barton, Shoe-lane—Improvements in apparatus for filtering sugar and saccharine juices.
1084. Richard Archibald Brooman, 166, Fleet-street—Improvements in machinery for felting or sizing hat bodies. (A communication.)
1086. William Edward Newton, 66, Chancery-lane—Improved machinery for cutting, punching, and forging, or swaging nuts or washers. (A communication.)
1087. Alexander Charles Louis Devaux, King William-street—Improvements in the construction of granaries.
1088. Alfred Vincent Newton, 66, Chancery-lane—Improved construction of rotary pump. (A communication.)
1089. Alfred Vincent Newton, 66, Chancery-lane—Improvement in bands for securing bales of goods, and for other like uses. (A communication.)
1090. Stephen Walter Underhill, Wellfield-cottage, Dunse, Berwickshire—The preservation of life in cases of shipwreck or other casualty at sea, the Buoyant Cushion.

Dated 9*th May*, 1856.

1091. Léon Louis Jardin and Joseph Blamond, 39, Rue de l'Echiquier, Paris—Improvements in engraving on stone, earthenware, china, and glass, and also in ornamenting the same.
1092. William Bayliss, Wolverhampton—Improvements in chains for collieries, cables, and other purposes.
1093. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in carding engines for carding cotton and other fibrous materials. (A communication.)
1094. John Wesley Hackworth, Priestgate Engine Works, Darlington—Improvements in machinery or apparatus for raising and lowering heavy bodies.
1095. Ferdinand Potts and Thomas Vann, Birmingham—Machinery for ornamenting, floating, burnishing, and polishing metallic tubes, part of which machinery is also applicable for performing the like operation upon other metallic surfaces.
1096. Edward Daniel Johnson, Wilmington-square—Improved mode of mounting marine chronometers.
1097. George Jordan Firman, Newton-le-Willows, Lancashire—Improvements in the manufacture of sulphuric, tartaric, citric, and oxalic acids, ammonia, and cyanides.
1099. William Basford, 16, Talbot-road, Kentish-town—Improvements in apparatus for purifying coal gas.
1100. Louis Beauché, Offenbach, near Frankfort-on-the-Maine—A machine for the manufacture of cigars.
1101. George Simpson, Leather-lane—Improvements in rotary knife-cleaning machines.
1102. Richard Archibald Brooman, 166, Fleet-street—Improvement in cranes. (A communication.)
1103. Richard Archibald Brooman, 166, Fleet-street—Improvements in machinery for the manufacture or finishing of tyres, hoops, and rings. (A communication.)

Dated 10*th May*, 1856.

1105. Richard Archibald Brooman, 166, Fleet-street—Improvements in machinery for manufacturing tubes and pipes, applicable also to the rolling of rods and bars. (A communication.)
1107. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in machinery or apparatus for cutting irregular forms. (A communication.)
1108. James Wallace, jun., Glasgow—Improvements in preparing, bleaching, washing, cleansing, and drying textile fabrics and materials and pulpy substances.
1109. Robert Wotherspoon, Glasgow—Improvements in hats and other coverings for the head.
1110. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in drying leather and dressed skins. (A communication.)
1111. John Ridal, Sheffield—Improvements in spring knife handles.
1112. William Burkin, Neate-street, Old Kent-road—Improved machinery for manufacturing painted cloths.
1113. Bartholomew Beniowski, Bow-street, Covent-garden—Improvements in typographical composition, and in the manufacture of logotypes to be used therein.

Dated 12*th May*, 1856.

1114. Charles Frederick Claus, Latchford, Chester—Moistening land, streets, and the better extinction of fires.
1115. Pierre Ernest Aimont—Improvements in manufacturing shoes and other coverings for the foot.
1116. Richard Whytock, Edinburgh—Improvements in apparatus to facilitate the printing of yarns or threads.
1117. Edouard Besnier de la Pontonerie, Paris—Improvements in the apparatus for consuming smoke. (A communication.)
1118. Barnett Samuel, Sheffield—Improvements in the manufacture of combs.
1119. William Edward Newton, 66, Chancery-lane—Improvements in machinery for pumping and forcing water and other fluids. (A communication.)
1120. William Edward Newton, 66, Chancery-lane—Improved machinery for splitting or cutting blocks of wood, for match splints, kindling wood, trenails, and other purposes. (A communication.)

Dated 13*th May*, 1856.

1121. Charles Butler Clough, Llwyn Offa—Improvements in elongating and contracting metal bars or rods for the obtainment of motive power.
1125. Alexander Parkes, Birmingham—Improvement in preparing materials for and in waterproofing and coating woven and other fabrics, paper, leather, and other substances.
1127. Robert Raywood, Penistone—Improvements in railways.
1129. William Edward Newton, 66, Chancery-lane—Improved machinery for removing snow from railroad tracks. (A communication.)

Dated 14*th May*, 1856.

1131. Henry Bragg, jun., Belfast—Improvements in machinery or apparatus for finishing linen and other fabrics.
1133. Hiram Groves, New York—Improvements in tune barrels or cylinders, or other apparatus for playing upon organs or other musical instruments.
1137. Alexandre Tolhausen, 7, Duke-street, Adelphi—Improved distance indicator for public carriages. (A communication.)
1141. Charles Henry Olivier, 37, Finsbury-square—Improvements in the mode of preparing and applying silk waste. (A communication.)
1143. William Crofts, Derby-terrace, Nottingham-park—Improvements in the manufacture of lace and other weavings.

WEEKLY LIST OF PATENTS SEALED.

Sealed May 23*rd*, 1856.

2640. Thomas Tuckey.
2644. Joseph Ellisdon.
2652. Juliana Martin.
2655. Louis Joseph Frederic Margueritte.
2665. Robert Bell.
2670. Enoch Tayler.
2675. George Louis Stott.
2693. Thomas Symons.
2700. John Ramsbottom and John Charles Dickinson.
2760. Henry Hart.
2773. Charles François Jules Fonrobert.
2785. Peter Armand le Comte de Fontainemoreau.
2787. Josiah George Jennings.
2788. Josiah George Jennings.
2789. Josiah George Jennings.
2807. Isaac Beardsell.
2940. Henry George Baily.
53. Samuel Cunliffe Lister and William Tongue.
136. Joseph Schloss.
380. Walter McFarlane.
434. John Henry Johnson.
458. William Strang.
537. François Rualem.
549. Thomas Lambert.
649. Peter Appleton.
691. James Bryant, jun.
707. John Dearman Dunnicliffe and Stephen Bates.
761. John McLean.

Sealed May 27*th*, 1856.

2680. Thomas Warren.
2685. Benjamin Rosenberg.
2688. William Alfred Distin.
2698. George North.
2745. Arthur Paget.
2774. John Radcliffe and Thomas Vickers Favell.
2781. James Cocker.
2832. Thomas Warren.
2843. Samuel Fletcher Cottam.
2848. Omrod Coffeen Evans, M.D.
2909. James Chesterman.
15. Charles Toye.
19. James Bagster Lyall.
90. Emile Constantin Fritz Sautelet.
106. William Owen.
276. Charles Robert Moate.
313. James Howard.
355. Thomas Steven.
502. William Exall.
571. The Chevalier Guillaume Hahner.
686. John Juckes.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

May 19*th*.

1259. Louis Gervais Dieudonné Buffet Delmas Ducayla.
1302. Julius Augustus Roth.
1316. Caleb Hill.

May 20*th*.

1258. William Chisholm.
1267. Auguste Edouard Loradoux Bellford.

May 22*nd*.

1271. Henry Turner.
1366. Isaiah Kendrick.

May 23*rd*.

1295. Alphonse Rene le Mire de Normandy.
1381. Benjamin Biram.

May 24*th*.

1313. Ebenezer Nash and Joseph Nash.
1350. Joseph Whitworth.